Wrong Side of the Tracks?

The Development of London's Railway Terminus Neighbourhoods

by

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I, Thomas Edmund Arthur Bolton confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signed,

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Thesis Abstract

The commonly-used phrase 'the wrong side of the tracks' implies that railway lines separate places as a matter of course, with economic and social consequences. London has more railway termini than any other world city, with apparent economic, social and spatial differences between places located in front of them and those behind. Contemporary research focuses on transport functions, on the economic potential of station buildings and on the potential for rail to increase catalyse redevelopment, while ignoring their role as the largest buildings in the city, creating separation within the street network.

This thesis analyses eight main London railway termini in two time periods: the 1880s and the 2010s. These stations are served by different infrastructure types, from cuttings to viaducts, which form movement barriers in areas located behind them, which are also associated with social decline and post-industrial redevelopment.

Space syntax analysis uncovers the impacts of railway termini and their associated structures on movement networks. The economic and social character of areas around the stations is then analysed, to identify differences between neighbourhoods in front of and behind stations. Historical data is mapped and compared with contemporary data, including land uses for both periods and social data from the Booth Poverty Survey, which is compared to contemporary income estimates.

Analysis of spatial, social and economic character shows how the railway has influenced neighbourhoods located behind termini over a long period of time. The nature of this influence depends on infrastructure type, viaducts being associated with less separation than other railway structures. This research is significant for the long-term redevelopment of railway termini, demonstrating their importance as an integral part of the city and the significance of understanding the separation they create.

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Chapter One: Introduction

This introductory chapter explains the rationale behind the research presented in this thesis, and is divided into six sections setting up the concepts to be critiqued and the research questions to be addressed. The opening section examines the significance of the expression 'the wrong side of the tracks', and is followed by an exploration of the concepts of 'front' and 'back' in relation to railway terminals. The academic approaches that have influenced this research are then introduced, and the relevance of London case studies to these ideas is explored. The research questions are then established and, finally, the structure of the thesis is set out.

The wrong side of the tracks

The expression 'the wrong side of the tracks' describes the relationship between railways and the places that surround them. As a description for a particular type of neighbourhood the phrase is widely used and understood and remains current, for example appearing as the title for a mission in the computer game 'Grand Theft Auto: San Andreas' (Rockstar Games, 2004). The 'wrong side of the tracks' stereotype encapsulates a combination of social and economic conditions, which are directly related to spatial setting. It describes the poor part of town which is dirty, polluted, dangerous, crime-ridden and disadvantaged. People from 'the wrong side of the tracks' supposedly come from unstable backgrounds, break the law and end up in prison. If they succeed, it is, according to the stereotype, against the odds. A survey of academic articles published over the past ten years reveals that the phrase has been appeared in the titles of papers on subjects including social provision for immigrants, trailer parks, toxic waste dumping, murder, racial segregation and working-class experience. While the 'wrong side of the tracks' shorthand is accepted, it is notable that the phrase itself has barely been critiqued or investigated.

'The wrong side of the tracks' idiom clearly carries accumulated, implied meaning, but its literal meaning is also under researched. The origins of the phrase are unclear, but it is said to be related to the pollution caused by steam trains, which deposited soot on building close to the tracks and made living too close to the railway an undesirable experience. However, soot would pollute both sides of a railway line equally, so this does not seem to provide a full explanation. More commonly used in the USA, a search of scanned online material reveals its use in publications rising rapidly from 1930 and peaking during the 1940s and 1950s, already used with its metaphorical rather than literal meaning, describing social division between neighbourhoods (Google Books, 2017). It is possible that this application became popular as new towns developed around a pre-existing railway line. A railway line creates a continuous boundary marker and is often fenced to keep people out, so if a fenced railway predates surrounding development, it creates a boundary which neighbouring streets have no option but to respect. Railways divide up undeveloped land, leaving other uses to fit around them. While data covering only online texts is by no means definitive, the phrase seems to have come back into greater use during the early 21st century, having peaked again in 2003 at a higher level than before (Google Books, 2017).

The phrase also carries a suggestion of permanence, claiming that the socio-economic character of places has been set by their location. By the logic of the idiom, it would only be possible to change the positioning of a place on the 'wrong side' by removing the tracks themselves. As long as the railway persists, the social division also persists. This has wide-reaching implications for the planning of railways within places, suggesting that at the least attention should be paid to the indirect consequences generated by a railway line. The 'wrong side' concept is accepted and employed as a useful shorthand for a type of place that is otherwise difficult to describe in a concise way. The key to the problems described lies in the spatial implications of the phrase itself.

London has more railway terminals than any other city in the world. The majority were built by private enterprises during the city's mid-nth century industrial expansion, resulting in a unique number of lines terminating in separate locations. Railway terminals are the largest buildings in central London and, along with the extensive networks of tracks that serve them, occupy significant amounts of space. Their physical size, as well as their strategic importance to the functioning of the city and the cost of funding in their development, means that they change over long timescales and still occupy the sites on which they were built up to 180 years ago. However, despite the prominence and permanence of London's terminals, their relationship to the neighbourhoods around them is under-explored. The station dominates, and improvement and change are commonly seen as dependent on its development. The impact of railways on their urban setting is often ignored.

Euston Station provides an example. Public experience of the station, one of the largest buildings in central London, is confined to the concourse and platforms, but the terminus and its approaches extend back more than half a kilometre before a road crosses the tracks. In front of Euston, the streets of Bloomsbury are busy with people and traffic, but only a few yards away behind the station the Regent's Park Estate and Somers Town, separated only by

Euston Road, are deserted by comparison. The streets behind the station seemingly belong to a different city to those in front, directly beyond its entrances and exits. The existence and the size of Euston Station and its tracks seem to have a bearing on the sharp contrast in street life, and the divergent economic and social histories of these adjacent neighbourhoods. Are places on which the station turns its back in some way disadvantaged by their location, and their relationship to a large terminus?

'Wrong side of the tracks' describes a situation in which the relative economic and social status of two places remain distinguished by their position in relation to railway lines. It implies that the separation created by a railway is too obvious to require further explanation, and has effects beyond physical impacts: a series of direct and indirect consequences which, in summary, mean that people with a choice do not choose to live in a neighbourhood on the 'wrong' side. Both familiar and overlooked, the wrong side of the tracks effect is apparently demonstrated in the vicinity of London's main terminals: while the capital's central business district lies just outside their front doors, the streets behind many of these stations are hidden, secluded and segregated. This thesis aim to explore whether this concept provides a valid understanding of the relationship between London's railway terminals and the places to which they belong.

Concepts of front and back

Railway stations are large, complex structures, but only a part of them is used by the public. The overall impression of a station is as a building, and it is experienced as such by the majority of those who use it. The public areas – concourses, waiting areas, ticket offices, shops, cafés and platforms – represent the station to most users. However, the station building is just the most visible element in a much larger infrastructure system. Within the confines of the station itself are many areas – operations rooms, offices, workshops, train sheds, service warehouses, goods areas, vehicle access routes, overline gantries, signal boxes, lineside walkways, sidings, the tracks themselves and more – which are only ever accessed by a small number of railway employees. While these functions occupy as much space as public station areas and more, even the wider station is only a small portion of a system of tracks and railway land that covers a far larger area. Tracks which connect one city to another must pass through each city to reach a central location, carried in cuttings or on embankments, buried in tunnels, or passing at ground level – 'at grade' – through the complex networks of buildings and spaces that form a city until they reach its edge and can continue through countryside to the next settlement. Public locations, regarded as 'the station', represent only a part of a station's footprint, and a small proportion of the footprint of the railway systems that cross many miles of land.

There is no separation between a station and the railway network of which it forms a part. The conception of a station as a stand-alone public building, like a theatre or a library, limits understanding of the role it plays in a city. A railway station and its tracks are distinct types of structure, distinguished by the likelihood that, once built, they will remain in place for a long period of time. Whereas the street network contains a certain level of flexibility, "rail track capacity is only useful if trains operate on it" (Schabas, 2016, p. xiii).

Railway routes are complex, expensive and often impossible to assemble within an established urban fabric. Once established, the form taken by railway use does not lend itself to other urban functions, being linear and separated by necessity from surrounding areas. Redevelopment of former railway land is possible when the footprint is that of a goods yards or a station, but it is often difficult to reintegrate the lines themselves into the surrounding city. Even when closed disused railway tracks can lie dormant for long periods of time, and their form is so particular that they have created a new urban form: the linear, elevated public park, best known in the form of the High Line park in New York but found in many other locations and "providing often surprisingly direct connections between places" (Carmona, Tiesdell, Heath and Oc, 2010, p. 142).

The persistence of station structures is significant because of the separation they create in the urban fabric. Stations are traditionally represented in terms of front and back, with the back areas carrying a reputation for illicit goings on which is explored in Chapter 2. Their reputation reflects the physical location of places behind stations as hidden in relation to areas in front. The particular layout of a terminus creates an inevitable division between front and back. While large stations can be located largely underground, burying their approaches in tunnels and limiting the interaction between buildings and railway lines and the surrounding city, this is not the case in London. Instead, terminals present an accessible, public front with large entrances, direct connections to other forms of public transport for onward journeys, and a location that provides access to areas of the city where employment and entertainment are found. Front station areas are accessible, although controlled, with entrances closed at night and rights reserved by the station owners to exclude anyone they choose.

Terminals also present closed rear areas, the converse of the public entrances, concourse and platforms, which are necessarily off limits because of the presence of live, dangerous transport operations. This is where railway lines access the station, occupying a space that matches the combined width of the platforms. The larger the station and the greater the number of services and passengers, the larger the inaccessible station approaches that are created as a consequence.

While the front of a terminus is specifically designed to be easily accessed, the back is designed to be secured and inaccessible. It is sealed both for the protection of individuals and the prevention of unauthorised access, and the size of a terminus inevitably creates an area of limited access, larger than other urban blocks. However, this effect is not confined to the station. Unless railway lines are buried, they can only be crossed via a limited number of bridges or tunnels. Therefore, the distinction between front and back extends to areas wider than the terminus itself. The 'wrong side of the tracks' concept indicates a broader separation effecting entire neighbourhoods. The front/back separation is a more specific version of this idea, generated by the particular physical properties of the terminus. Although the terminus is a characteristic London structure, it is rarely seen as such or studied as a typology. The caricature of respectability in front of stations and seediness behind is well known but little questioned. London's terminals collectively define the edge of inner London, as they did when first constructed in the nineteenth century. However, they were each built in distinct settings and circumstances, so an investigation of extent of the front/back effect needs to examine each station as part of a place with its own particular character and history.

Railways and blight

The spatial implications of the presence of large stations were explored by Bill Hillier and colleagues in the 1990s. A causal connection between London terminals and spatial ''blight" is theorised in relation to the spatial impacts of King's Cross and St. Pancras Stations by Hillier, Penn, Hanson, Grajewski and Xu (1993), who describe the relative absence of pedestrian movement from streets located behind the stations, away from the station exits. To understand the nature of the effects suggested, the use of the term 'blight' needs to be questioned.

''Blight" has become associated with the unintended consequences of development in cities. Its origins are as a description of the effect of atmosphere. The Oxford English Dictionary defines the word as describing unidentified diseases of "assumed atmospheric origin" which "arrest growth" (OED Online, 2017). In horticulture, blight will not only destroy plants, requiring their destruction, but may poison the soil meaning that nothing can grow there again. The horticultural definition of ''blight" has extended to encompass "any malignant influence of obscure or mysterious origin; anything which withers hopes or prospects, or checks prosperity" (OED Online, 2017).

Like many other analogies between cities and ecosystems or organisms, the definition of blight has moved away from its origins towards particular application in cities. It is also described as "something that impairs or destroys" or "something that frustrates plans or hopes" (Merriam-Webster, 2017). Lewis Mumford was an early user of the term in relation to urban development in 'The Culture of Cities' (1938). He describes ''blight" as an inevitable stage in the development of a city, a period of low values in a particular area which brings in inhabitants of "lower economic strata" and leads to dilapidation and crime (Mumford, 1938, p. 137). He defined ''blight" as an economic problem with social consequences, caused at least in part by excessive development leading to overcrowding.

However, the accepted meaning of the term has since shifted, in more than one direction. It is now used in relation simply to appearance – "an unsightly urban area" (OED Online, 2017), and has become defined in United States law in relation to the condition of housing. As a result, the condition of blight is seen as a politically expedient term, used to justify the demolition of areas deemed to be "blighted" and destined to become "slums" without intervention (Pritchett, 2003).

In a UK context, ''blight" does not carry legal weight and is a poorly defined term without a clear, commonly understood meaning. It is more suited to use as "a rhetorical device" (Pritchett, 2003, p. 3) than as a precise explanation of urban conditions and their cause. This term requires investigation if the trajectory linked to a location on 'the wrong side of the tracks' is to be investigated. Socio-economic indicators which have been associated with ''blight" need to be identified, and assessment of station areas carried out to understand whether particular areas can be consistently identified with these.

The application of the term to railway station back areas, with these connotations of holding an area back and preventing it from becoming what it might otherwise be, has been connected with the spatial impacts of a large station. Hillier *et al.* identify a pattern of pedestrian movement levels which falls away sharply only a single block beyond the entrances of the stations. They describe this as a "negative attractor" effect, in which stations create large blockages despite being "point attractors" themselves, drawing people towards particular entrance points (Hillier *et al.*, 1993, p. 50). The paper called for further research to investigate the effects of stations as "negative attractors" in creating "an almost uniform blight" on their nearby areas (Hillier *et al.*, 1993, p. 50).

A decade later, Paksukcharern’s thesis study examined Hillier’s theory by analysing the spatial setting and researching movement patterns at each of the London terminals (Paksukcharern, 2003). The ‘negative attractor’ concept was largely confirmed in the locations she studied, but the study concentrated on the station as represented in public perception. Terminals were investigated as public locations insufficiently connected to their surroundings, placing the discussion wholly within the context of regeneration of failing areas. Paksukcharern narrowed the concept of ‘’blight” considerably, representing it as a problem to be solved through redevelopment of railway-owned land. The failure to develop trackside areas where proximity to a railway line has made construction impractical was a particular focus. A focus on the station and tracks misses the wider relationship between a terminus and its “back areas”, those areas that contain stations and their approaches.

Space syntax measures the configuration of street networks, identifying their relative potential to attract different types of movement. It is an appropriate research methodology for exploring how far Hillier’s “negative attractor” hypothesis can be evidenced in the vicinity of London terminals, and whether far it relates to notions of railway blight. Spatial factors can provide only part of the explanation for the multi-layered historical, economic and social processes operating on any given section of city. However, there is reason to suspect that railways generate particular spatial effects, and this analysis uses spatial techniques to understand what these may be. Blight also implies a temporal process of change, so analysis of historical spatial configuration is also employed, along historical textual research.

The idea the back areas of railway stations are synonymous with ‘’blight” has remained a consistent element of the discourse around their role in the city since the early days of the nineteenth century railway boom. Evidence to the 1846 Metropolitan Railway Commission, discussed in Chapter Five, makes it clear that the prospect of railways causing economic and social as well as physical damage to London neighbourhoods was a fully formed and articulated fear among enquiry witnesses (Dyos, 1955; Briggs, 1968; Kellett, 1969). The railways were blamed by contemporaries for the decline of areas they crossed. Contemporary views of railway construction revealed the urban chaos and disruption they caused, the best-known example being Charles Dickens’ description of the impact of railway construction in Camden in his novel ‘Dombey and Son’:

> “The first shock of a great earthquake had, just at that period, rent the whole neighbourhood to its centre. Traces of its course were visible on every side. Houses were knocked down; streets broken through and stopped; deep pits and trenches dug in the ground; enormous heaps of earth and clay thrown up;

> buildings that were undermined and shaking… In short, the yet unfinished and unopened Railroad was in progress; and, from the very core of all this dire disorder, trailed smoothly away, upon its mighty course of civilisation and improvement" (Dickens, 1848, p. 45).

Construction caused huge disruption, but the social after-effects were more significant and widespread. Research by Dyos (1955, 1967, 1973, 1982), Kellett (1969) and Olsen (1964) into the circumstances, processes and impact of railway construction on Victorian cities, and on London in particular, remain definitive accounts. While the influence of their work reflects the detail and insight they brought to the field, the continuing prominence of their research fifty years later suggests that the social processes of London's construction remain both relevant and fertile areas for research.

Dyos in particular investigated the impact of railway construction on wider neighbourhoods. Dyos concluded that when housing was demolished for railway construction in London, "surrounding areas that received the displaced poor deteriorated still further" (Dyos, 1955, p. 19). For example, Binford shows that "nineteenth century commentators blamed the decline of North Lambeth as a whole on two rounds of railway construction" (Binford, 1974, p. 138). The arrival of the railway, it was believed, had led directly to the area's reaching a point where it had become known informally as "poverty corner", notorious both for prostitution and for degraded housing (see Chapter Eight for further analysis).

Discussion around the twenty-first century redevelopment of terminus neighbourhoods has revolved around similar concepts of "blight". For example, the King's Cross Central development on the former Great Northern and Midland Goods Yards behind King's Cross Station, under construction since 2008, has been accompanied by a consistent public narrative about the transformation of a back station area with "a reputation, sometimes exaggerated but nonetheless based in reality, for prostitution and drugs" (Moore, 2014). The association between the back areas of London terminals with illicit activity has largely disappeared with the arrival of King's Cross Central. Former goods yard areas and industrial back lands, on the whole, no longer stand empty. The repopulation of inner London since the 1990s has reversed a post-war decline that reduced demand for land in central London while, during the same period, heavy manufacturing and transport functions vacated large, central sites. By the mid-2010s large, ex-railway or industrial areas behind London's terminals were either redeveloped or under redevelopment, bringing a different character to streets close to the stations. The block alongside Euston Station at Nos. 34–70, Eversholt Street (featuring two erotic video shops, one pornographic bookshop and a lap dancing bar at the time of writing) is the final, visible London remnant of the illicit businesses associated with the transient users of stations since the nineteenth century, although some of the same activities continue in a less conspicuous manner.

But if such traditional indications of "blight" in the immediate vicinity of London terminals have receded during the first two decades of the twenty-first century, does that mean that the neighbourhood scale effects also observed in station back areas during the nineteenth century have also disappeared? Charles Booth's survey 'Life and Labour of the People in London. Volume 1: Poverty', carried out in the 1880s and 1890s, frequently blamed both isolation and proximity to industry and infrastructure with poverty and long-term decline of streets. Dyos connected this phenomenon particularly with the construction of railway lines, writing that "the sealing off in this way [with a new railway viaduct] of a small network of streets close to a main road was a fairly prolific source of slum conditions" (Dyos, 1967, p. 112). Most of the railways the Booth Survey identifies as sources of poverty are still operating in the same locations, as are London's railway terminals. If their locations remain unchanged, then their effect on their surrounding is also likely to persist. If railways were relevant to understanding socio-economic patterns in the late nineteenth century city, there is reason to suppose they are also relevant to understanding contemporary London.

Mid-nineteenth century Victorians were acutely aware that railways had the potential to change the neighbourhoods of which they were part. However, railways are now an ordinary, accepted feature of urban life, and no longer stand out as unusual. Although diesel engines do still pollute, trains no longer discharge smoke into the surrounding streets to the extent they once did, and are promoted as an environmentally sustainable mode of travel. They have become part of a larger transport network within London, and are no longer an unusual phenomenon. They also often operate out of sight, concealed in cuttings and behind buildings, rather than alongside publicly accessible routes. Awareness of railways in London beyond the station areas used by passengers is limited, and the perceived impropriety of peering into back gardens from carriages long forgotten. The huge disruption as railway lines intruded into the city for the first time has also passed into history, and railway projects are restricted to a few sites at any given time.

The experience of travelling by train is one that separates passengers from the city. Although trains pass through many miles of developed London en route to its terminals, interaction is impossible between those sealed inside carriages and their surroundings. They are intentionally separated from urban life and can only gaze at the scenery, often while passing through at speed. The lack of connection between railways and their cities can create an impression that they are not really part of the city at all. However, their physical size would suggest otherwise, and the association throughout their existence between terminals and concepts of 'blight' clearly implies a direct link between railways and the fortunes of places close to them.

Railway terminals in London

This research seeks to test the extent to which railway terminals have an effect on the areas that surround them. It aims to identify evidence of blight through spatial, social and economic indicators. It does so by examining case studies located in London. London has more railway terminals than any other city in the world and continues to be shaped by the presence of large stations, by their expansion and development, and by the many miles of railway lines that cross London.

The terminals lined up along Marylebone-Euston-Pentonville Road – Euston, King's Cross, Marylebone, Paddington and St. Pancras Station – are the most obvious consequence of the 1846 Railway Terminals Royal Commission report on the siting of new stations (Metropolitan Commission, 1846). Faced with nineteen separate proposals to build central London terminals in 1846 alone, the Commission was set up to manage the situation. It recommended an exclusion zone, which prohibited new railway projects between Euston Road and the Thames. The existence of Euston Station, which had opened in 1837, determined Euston Road as the edge of the exclusion zone, while London Bridge Station, completed the previous year on the south side of the Thames, helped to establish the river as the southern boundary. Although these recommendations were later side-stepped in various ways, they were in force during the 1840s and 1850s. King's Cross and St. Pancras Stations were built as close to the centre as permitted, in areas less intensively developed than the more established neighbourhoods south of Euston Road.

A 'wrong side of the tracks' effect can apparently be seen in operation at these stations. Where railway infrastructure is particularly complex, for example where approaches combine behind Euston, King's Cross and St. Pancras, areas of extreme separation are created, with sections of land virtually surrounded by railway lines and, as a result, unsuitable for anything other than railway support uses. The largest of these areas is bigger than any station or any other central London building, reaching the scale of a small neighbourhood. The Maiden Lane Junction, at 106,750m^2, is bigger than London's largest terminus by area, Euston Station, at 95,850m^2. In places such as these, blight is easy to identify, as the areas in question are prevented by their relationship to the railway from playing a functional role in the city. However, the thesis seeks to identify effects across the full range of railway neighbourhoods defined for study, which combine varying locations, histories and infrastructure types. The research seeks impacts connected to the presence of the railway over long periods of time to assess the nature of blight.

Urban change in London

This study analyses how far the development of areas surrounding railway terminals can, over a long period of time, be related to the presence of railway structures. However, it is not possible to examine the spatial effects of these particular structures independently of the multiple process of urban development, change, decline and renewal seen in London over the past 130 years. As Chapter Three: Methodology describes, an analysis approach has been devised to define parts of the city through their proximity and relationship to railway stations and structures, and to make diachronic comparisons between them using a variety of measures of spatial, social and economic change. The long interval between the two data points – the 1880s and the 2010s – is central to this thesis, being a methodological approach that permits an understanding of urban change as a continuous, long-term process operating beyond political, economic or human lifecycles.

As discussed further in Chapter 3, the 1880s has been selected because it is a period close to the high point of railway terminal presence in London for which particularly powerful social data is available, via the Booth Poverty Survey (Booth, 1902). Nevertheless, these two periods represent only a part of the entire railway era, and a smaller portion of the period during which the areas surrounding each terminus have been in existence. The places analysed are therefore influenced by factors already in place before railway terminals were constructed, and also by factors that have influenced change between the 1880s and the 2010s which are not directly related to the presence of the railways.

The analysis spans a period of highly dynamic social change, destruction and conflict and both economic and physical reconfiguration. The railway neighbourhoods defined for analysis have all undergone improvements and declines in their fortunes over various periods since the 1880s and, like any other part of the city, none has experienced a linear process of change. They have all been influenced both by processes of global change, and by local factors with their own particular influence. The latter include, in particular, the setting in which each station is located. Each has a different combinations of landscape features such as rivers, canals and parks constraining development in different ways. The relationship of each site to the built-up city also differed from location to location, when they were first constructed. Individual, place-specific factors are discussed in each analysis chapters, but several processes of wider urban change should be acknowledged.

Land ownership patterns have historically shaped the development of central London, and continue to do so. London's 'Great Estates', land developed for leasehold by a small number of aristocratic families, determined the expansion of central London from the eighteenth century, and four of these estates are relevant to the railway terminals studied in this thesis: the Bedford Estate, covering Bloomsbury; the Howard de Walden Estate, covering western Marylebone; the Portman Estate, covering eastern Marylebone; and the Grosvenor Estate, which includes Belgravia. These areas were laid out as planned developments, with their own architectural and social coherence, and the land-owners have managed their subsequent development in the long-term interests of estate beneficiaries. All the London terminals north of the river are located beside the boundaries of the estates, leading to contrasting types of land ownership on either side of these stations. Relatively coherent ownership and management of 'Great Estate' areas in front of the terminals contrasts with the more fragmented ownership and development found in non-estate areas behind them. On the one hand, this situation has undoubtedly contributed to different development trajectories either side of railway terminals; on the other hand, the presence of terminals and railway lines has rendered areas on the 'wrong side of the tracks' less suited to coherent development. Indeed, where 'Great Estate' approaches have been attempted in such areas, for example the Bedford Estate's attempts to develop Bedford New Town, behind Euston, and St. Pancras, they failed principally due to railway construction (Olsen, 1964). Neither are all estates equal, with the extensive Church of England land ownership in Lambeth and Southwark enabling rather than preventing poor housing and subsequent demolition for railway lines (Kellett, 1969). The balance between cause and effect in relation to land ownership is debated in more detail in each analysis chapter.

A change factor particularly relevant to the terminals on the south bank of the Thames is the changing significance and uses of the riverfront between the two study periods. In the 1880s, the Thames in central London was an industrial river, with factories, warehouses and wharves concentrated on the south bank. The riverfront between London Bridge and Waterloo Stations was primarily a working area, although also containing housing. By the 2010s, industrial and river transport uses had virtually disappeared and the Thames in central London was comprehensively de-industrialised. Former industrial buildings have been redeveloped as housing, retail or offices, and new commercial, cultural and institutional uses introduced. In many respects the economic profile of these locations has changed almost entirely since the 1880s. This process is most apparent in south bank locations, because riverside change has been particularly sweeping. However, de-industrialisation can be found in the vicinity of every terminal analysed in this thesis. Areas surrounding all the terminals hosted industrial uses, mostly those behind the stations, and these too have almost entirely altered since the late nineteenth century. The shift to a post-industrial London economy and the physical changes entailed are a significant aspect of the change that has taken place between the two periods studied. The extent to which this has impacted differently is discussed in the analysis chapter.

The changing governance structures in London between the 1880s and the 2010s is also relevant to understanding the nature of urban change in the study areas. Prior to the formation of the London County Council (LCC) in 1889, there was no single local government body for London. Responsibility for the provision of local services lay at parish level, with the local vestry. The LCC, and the 28 metropolitan boroughs created as lower tier authorities in 1900, introduced new co-ordination to urban development, particularly in the provision of social housing and transport. Borough boundaries influenced the nature and extent of change to some extent, so it is potentially significant the Marylebone-Euston Road formed the boundary between the Boroughs of Marylebone and Paddington to the north, and Westminster to the south, while the River Thames separated boroughs either side. Several terminals were therefore located on borough edges, with different boroughs in front of and behind them. Equally, separation between boroughs was determined partly by existing land ownership, and by the perceived edge of central London. The London boroughs were amalgamated into larger areas in 1965, eliminating the administrative separation caused by Marylebone-Euston Road, although not by the Thames. After the abolition of the Greater London Council, successor to the LCC, in 1986 the Boroughs formed the only tier of London government until 2000, when city-wide governance was re-established in the form of the Greater London Authority. These shifting governance arrangements affected development differently depending on location between the 1880s and the 2010s, and the relationship of such boundaries to railway terminals forms part of analysis and discussion.

Another comprehensive change factor, which affected all the areas studied to varying degrees, was the damage caused by bombing during the Second World War. Bombing undoubtedly altered the city substantially and both railway stations and the industrial areas often located nearby were important targets, although damage to London terminals was relatively limited. However, bombs wrought damage across central London and, rather than being focused around railway stations, widespread destruction occurred across an area encompassing the entire centre of London on both sides of the Thames. Bomb damage is discussed as an agent of urban change in individual analysis chapters. However, post-war rebuilding appears to be a more directly relevant factor to the study of stations. Slum clearance and the replacement of older housing with council estates pre-dates the Second World War, but was focused and accelerated by the need to reconstruct damaged areas and by the opportunities bomb damage created for wider rebuilding. As a change factor, the modernist housing projects which became symbolic of post-war rebuilding were influential across the entire city, resulting in particularly significant changes to the built fabric. This particular era of rebuilding is important for the study of spatial layout, as the development of council estates frequently involved the remodelling of street layouts to separate pedestrians and vehicles and, as a consequence, radical changes to spatial connectivity. Each analysis chapter therefore investigates the nature and extent of rebuilding in areas surrounding stations, and examines the relationship of housing estates to railway terminals, as one aspect of change over time.

It is also worth noting that railway terminals, when first constructed, were built much closer to the edge of the built-up city that is now the case, in many cases at what was the edge of London when they first opened. Since the nineteenth century, the city has grown around and past all of them, and all are now located in the centre of a metropolis that extends many beyond them. This shift in the situation of the terminals, from an edge to a central location, is one of the aspects of change studied in this thesis. While this overall pattern of centralisation appears similar across all stations, a closer inspection reveals that the site of each station has its own peculiarities and particular characteristics. Taken together, the terminals do not lend themselves as easily to broad characterisation as may first seem the case. A detailed case study is therefore developed in each case to ensure the particulars of each station setting are considered, and the assumptions of the ‘wrong side of the tracks’ stereotype challenged.

Railway terminals as dynamic structures

Railways continue to expand, and current plans involve major change at five London terminals over the next thirty years. At the time of writing, construction is nearing completion for Crossrail/The Elizabeth Line, including major redevelopment at Paddington Station. The complete reconstruction of London Bridge Station is well advanced. The expansion of Euston Station for the High Speed Two line is just beginning. New entrances are opening at Victoria Station, involving the redevelopment of blocks in front of the station. The disused former Eurostar platforms at Waterloo Station are being rebuilt. Planning is underway for a Crossrail 2 line, including new stations at Euston, St. Pancras and Victoria and extensive associated works. In the past decade, King's Cross and St. Pancras Stations have been rebuilt and reconfigured and even the smallest terminus in this study, Marylebone, has brought disused platforms back into use and expanded to the full limits of its constrained site. Development is not confined to stations themselves, but extends into their surroundings. The King's Cross Central development occupies former railway land, while controversial proposals for a development on the site of a former Royal Mail sorting office next to Paddington Station, known as The Paddington Cube, aim to catalyse wider change in the station's immediate neighbourhood.

The London Infrastructure Plan 2050 includes further plans for changes likely to affect railway neighbourhoods, including "iconic, place-changing schemes" (Mayor of London, 2014, p. 40) for Euston, Vauxhall Cross and the Westway and "transforming the national rail network within London" (Mayor of London, 2014, p. 34) to increase passenger and freight capacity. These plans all involve long-term construction, and varying degrees of disruption and permanent change including demolition of existing buildings and the closure of streets and public spaces. Railways may be familiar but they are far from settled, unchanging features of the city. While the removal of goods capacity from London terminals led to the release of large areas of railway land for redevelopment during in the later twentieth century, the terminals themselves have expanded more than they have contracted throughout their existence, and continue to do so.

Major stations and railway lines continually change, needing upgrading and expansion, and this often requires demolition of neighbouring properties or, in the case of the Euston HS2 station, substantial sections of adjacent neighbourhoods. London's terminals move, but the scale of railway projects is such that major changes take place only once or twice in a lifetime. So, if stations are still expanding at the expense of their surroundings, as they did in the nineteenth century, do they continue to blight their surroundings, and can evidence of blight be drawn from the heyday of the railways in the late nineteenth century?

Collectively, the city's largest terminals continue to mark the edge of central London as it was when the majority of them were first built. However, the picture is more involved: terminals were constructed in different decades and circumstances, and occupy varied urban settings both then and now. The question of how the railways affect the relative fortunes of its neighbourhoods is, therefore, as current now as it was in 1846, significant to our understanding of the twenty-first century city.

This research uses space syntax analysis to broaden the concept of blight by analysing wider railway neighbourhoods. It tests the hypothesis that the presence of railway terminals in London has influenced the spatial, social and economic character of neighbourhoods; that any influence differs depending on the location of neighbourhoods in front of or behind a terminus; that the nature of this influence differs depending on infrastructure type; and that influence can be identified over a long period of time. This thesis provides an exploration of the long-term spatial, social and economic outcomes that may arise from the presence of railway terminals in London and, through this subject, asks what the relationship is between urban intervention and long-term processes of change in cities.

Research questions

This thesis addresses two main research questions, with sub-questions, as detailed below. The first research question asks what the impact is of urban intervention on long-term processes of change. It investigates this question in the context of London railway terminals. Two sub-questions ask whether identifiable differences exist between areas in front of stations and areas behind, whether they can be linked with economic and social disadvantage, in the 1890s and the 2010s, and whether these differences amount to 'blight'.

Research question 1:

1) What is the long-term impact of London railway terminals on their neighbourhoods?
    a) Can distinct spatial characteristics be identified in neighbourhoods surrounding London railway terminals?
    b) What spatial, social and economic patterns can be observed over time in terminus neighbourhoods?

These questions investigate the concept of blight, but also look for patterns in areas around stations without assuming that these will be simply manifestations of blight. By comparing neighbourhoods, the research aims to understand whether different spatial, social and economic profiles can be identified, depending on the relationship of each area to a railway terminus. The 'wrong side of the tracks' concept will therefore be tested to discover whether it is true, to what extent and in which locations.

The second research question asks whether spatial characteristics can be used to identify areas of London in proximity to rail terminals as 'railway neighbourhoods':

Research question 2:

2) Do London terminals 'blight' their neighbourhoods?

This question aims to discover whether areas can be defined according to their relationship to a railway terminus. If there are identifiable differences between neighbourhoods adjacent to a terminus, can they be divided into 'front' areas and 'back' areas with distinct and different characteristics? If so, it asks whether back areas disadvantaged in relation to 'front' areas, or are any other patterns apparent. Together, the research questions analyse the 'wrong side of the tracks' concept in the context of London's main terminals, to create a better understanding of how far the development of London has been influenced over time by the presence of the eight terminals studied in this thesis.

Thesis structure

This thesis is divided into ten chapters. The Literature Review assesses theories of the spatial, social and economic impact of railway construction since the nineteenth century, of spatial exclusion and marginalisation in relation to urban infrastructure, and of twenty-first century station redevelopment. The Methodology chapter lays out the approach to defining analysis areas, and carrying spatial, morphological, land use and social analysis.

Chapters Five to Nine apply the selected methodological approaches, terminus by terminus, to create a morphological, spatial, economic and social profile for the areas surrounding each of the eight London railway terminals selected for study. Terminals grouped in a single chapter where their analysis areas overlap, as explained further in the Methodology chapter. Analysis has been conducted on a diachronic basis for the 1890s and the 2010s, to examine change over a time period that extends beyond individual political cycles or planning timescales from conception to completion.

The analysis chapters are presented in order of station construction: London Bridge; Euston, King's Cross and St. Pancras; Paddington and Marylebone; Waterloo, Victoria.[1] The Discussion and Conclusions chapter then draws out and debates the collective implications from the case study analysis, and summarises the thesis findings.

[1] Other London terminals have been excluded from the analysis, for reasons discussed in Chapter Three – Methodology.

Chapter Two: Literature Review

Introduction

The socio-economic character of London's railway terminus neighbourhoods has developed alongside the long-term presence of stations and their structures, and through the evolution of concepts about the form and role of transport provision.

This literature review is organised thematically under headline topics, which are used to introduce the spatial and socio-economic questions addressed by the thesis, as they arise. Four areas of literature are reviewed. Firstly, the aims, objectives, and consequences of Victorian infrastructure construction in London are assessed. This literature helps to reveal how the relationship between London terminals and their surrounding areas developed in the early decades of railway construction, and how this relationship was represented and interpreted by contemporaries.

Secondly, literature on marginalisation, separation and segregation is reviewed, to examine the research base on the barrier effects of infrastructure and its links to social and economic character of urban areas.

Thirdly, literature is reviewed on the application of spatial analysis techniques to questions of historical, social and economic development, to understand how it can provide insight into the impact of railways, stations and other forms of infrastructure over time.

Fourthly, literature on the contemporary construction and development of railway stations has been reviewed, to place decisions on expansion and changes to London terminals in the context of twenty-first century, international thinking on the role of rail. Research gaps are identified relating to the long-term role of railway terminals in cities in general, and London in particular. The use of historical analysis approaches is proposed as a means to understand the likely impact of current railway development decisions and the urban context in which they are made.

The origins of London's railway terminals

The beginnings of the railways in London shed light on the long-term relationship between stations and their surroundings. The core of the London railway network is the group of large terminus stations which first opened between 120 and 180 years ago. Decisions on their location, and the route of the lines that connect them, were taken in an era that is now politically and culturally distant. However, their construction initiated a long-term process of railway operation, expansion, alteration and redevelopment which continues today in these same locations, selected by the Victorian railway pioneers. The presence of large stations has created particular spatial configurations which reflect a lengthy history of transport development.

Railways were introduced to London in a social context that was not simply concerned with the provision of transport routes. There was also a direct connection between the choice of routes and the demolition of what was described as 'slum' housing. Railways socially reconfigured the areas of city they occupied. Many decades later, railways and stations remain, but the impact they had on their immediate surroundings when built is no longer seen as relevant. However, a full understanding of London's railway terminus neighbourhoods requires research that includes historical as well as contemporary perspectives. This approach reflects the relative permanence of railways, and allows effects associated with their presence to be examined on the same timescale.

Schabas (2016) suggests that decisions made many decades ago on the design and routing of London's railways continue to dictate passenger journeys because "once built, railways are hard to change" (Schabas, 2016, p. xiii). This tells only part of the story because decisions taken in the nineteenth century continue to shape not just the passenger experience, but also appear the experiences of life in the vicinity of the railways.

The railway boom

London's nineteenth century population growth was supported by an unprecedented infrastructure boom. The introduction of the railway in England brought opposition from owners of competing canals, and from landowners whose land they passed through. However, this quickly gave way to a "Railway Mania" (Simmons, 1961, p. 12) with nineteen rail routes planned for London alone in 1845. The railway boom began in London in the 1830s, and between 1837 and 1899 thirteen railway terminals were built at the edges of central London. This process "substantially changed the face and structure of London" (Dennis, 2008, p. 12), creating and defining borders and entrenching separation and segregation than can still be seen in the same locations nearly two centuries later. The extensive demolition required to clear construction space in a densely developed city was represented by a wide range of contemporaries as a positive benefit. New rail and road schemes were seen as opportunities to tackle the conditions of extreme poverty that existed in parts of central London by demolishing poor quality 'slum' houses (Yelling, 1986).

The era of new transport infrastructure, which had begun with the building of the canal network at the start of the nineteenth century, accelerated with the arrival of the railways, which enabled London to expand to an extent that would previously have been impossible (Olsen, 1964). New railways and stations linked the city to the rest of Britain, with the basis of a national railway network constructed in a remarkably short space of time, between 1803 and 1845, in feats of construction likened by contemporaries to the construction of the pyramids (Freeman, 1999).

Olsen observed that "nowhere does Victorian London survive today more vigorously than in its railway terminals" (Olsen, 1976, p. 98). However, despite their architectural qualities, London's terminals also "stand for the folly of unrestricted competition" (Olsen, 1976, p. 98). Rather than a publicly planned and control national rail network, the new system was built by private companies which competed to finance, construct and operate routes. However, creating the space needed for new rail lines and large station buildings was disruptive and destructive, especially in areas that were already built-up, and applications for routes and terminals serving central London reached a scale that concerned the Government. After the initial railway boom of the 1830s, locations for new railway terminals in London were regulated by legislation designed to prevent extensive demolition of property. The 1846 Royal Commission Appointed to Investigate the Various Projects for Establishing Railway Terminals Within or in the Immediate Vicinity of the Metropolis (known as the Metropolitan Railway Commission) was established to manage competitive applications for central London stations, and to agree the approach the capital would take to establishing railway connections. It decided against a single, central station, opting to continue the competition among railway companies. The Commission established a railway exclusion zone, bounded by Park Lane to the west, New (later Euston) Road to the north, the eastern border of the City and the South Bank. The exclusion zone was eventually breached, with Charing Cross (1864), Broad Street (1865), Cannon Street (1866), Liverpool Street (1874) and St. Paul's (1886, later renamed Blackfriars) all subsequently permitted within its boundaries. Nevertheless, this zone came to form the boundary of modern central London, with a series of railway terminals built in a ring around its edges (Hoyle, 1982).

Simmons suggests that, despite the efforts of the Metropolitan Railway Commission, the deluge of "Railway Mania" proposals resulted in long-term problems as competing companies failed to amalgamate, although it would have been in the public interest for rail services to be better co-ordinated (Simmons, 1961). Competition caused London to acquire an unequalled number of rail terminals within a few decades, nearly all of which remain in operation today. The unique situation in London may have been partly due to the perception of London and its economic requirements as also being unique. Rasmussen suggests that "…the traffic in and out of London was allowed to develop quite independently of all municipal boundaries. The City proper was such restricted territory that the idea of hindering people from moving away from it was out of the question" (Rasmussen, 1982, p. 132). Railway terminals were built primarily for the benefit of London's economic centre, over-riding local development considerations. Locations for new terminals were viewed as blank spaces on the map, and judged by their convenience as city centre access points.

Infrastructure and social change

The construction of the railways in Victorian London has been closely connected by a number of researchers to both direct and indirect social change. Infrastructure was introduced in a destructive manner, with existing buildings cleared to create routes for new roads, canals and railways. The extensive demolition required to clear construction space in a densely developed city was represented by a wide range of contemporaries as a positive benefit. New rail, road canal and industrial schemes were seen as opportunities to tackle the conditions of extreme poverty that existed in parts of central London by demolishing poor quality 'slum' houses (Yelling, 1986). John Nash's Regent Street project, which began in 1814, was the first major infrastructure intervention of the nineteenth century, was regarded as an estate improvement project by the landowner, the Crown. The alleys and courts of Soho, to the east of the eventual route of Regent Street, contrasted with larger, more desirable dwellings to the west (Dyos, 1982). Summerson demonstrates that the route of the new street was carefully chosen to create a clearer separation between the richer west and the poorer east side of the road (Summerson, 2003).

However, Dyos connects the construction of transport infrastructure, especially railways, to neighbourhood decline and points out that "it was sometimes possible to run through the complete declension from meadow to slum in a single generation, or even less" (Dyos, 1982, p. 141). The process begun in the Regent Street scheme, reinforcing existing social divisions by introducing transport routes as boundaries, was to be repeated throughout the century as the Victorian city was constructed, through the introduction of both new roads and new railways. Dyos quotes a Times editorial from 1862: "You can never make these wretched alleys really habitable, do what you will; but bring a railway into them and the whole problem is solved" (Dyos, 1982). A consistent motivation behind such schemes was the improvement of housing quality, linked closely in reformers' minds with conditions of public health. According to Dyos, in several cases the routes of new roads and railways were determined principally by the optimum number of areas of densely occupied poor quality housing that could be "drained" through demolition (Dyos, 1982, p. 82).

Stedman Jones shows that the combined effect of demolitions for railways, docks, warehouses and new streets caused "a vast migration from central districts between 1850 and 1901" (Stedman Jones, 1971, p. 161) and suggests that, of all these improvement schemes, the railway companies were responsible for displacing the largest number of people. The railway companies were attracted to routes through parts of London where cheaper, less desirable properties were located, which cost less to acquire and where there was less resistance to their demolition (Reeder, 1984). This did not necessarily mean that less demolition occurred. The extension of the lines from a temporary terminus at Nine Elms to a new station at Waterloo (1846–8) required the purchase and clearance of 1,600 cottages and other premises (Kellett, 1969). Even where London estate owners put up resistance, the railways could obtain access eventually. The Duke of Bedford spent 50 years fighting the routing of the London and North Western approaches to Euston Station through Ampthill Square on the Bedford Estate, but was finally obliged to sell the relevant properties for demolition in 1887 (Olsen, 1964).

Various researchers have argued that infrastructure projects contributed to the creation of new slums, as well causing the demolition of existing ones. The construction of St. Pancras Station required the demolition of 4,000 Somers Town houses in 1868, displacing 32,000 people (Simmons, 1978). Somers Town had not become the middle class area originally intended, but was "a thriving working class neighbourhood" in the 1830s (Olsen, 1964, p. 63). However, when construction began on Euston Station its properties were allowed to deteriorate and jerry-building began in the gardens of larger houses, increasing density. Eventually it became sandwiched between St. Pancras and Euston Stations. Extensive demolition to build St. Pancras Station and the adjacent Midland Goods Depot reflected the reduced value of its properties, and by 1901 remaining houses in the areas were being cleared as slums (Jeffrey, 2008). The combination of partial demolition and the change from a residential area to one dominated by passengers, trains, goods yards and industry, had created a poor district where one had not previously existed.

The railways also brought railway workers, whose presence changed the demographic in areas built for inhabitants with higher incomes. The Cumberland Market neighbourhood, consisting of housing intended for the middle-classes, changed in character when Euston

Station was constructed nearby bringing "noise, dirt, Irish navvies, and semi-itinerant railway workers" to the area (Sturgis, 2005). Houses were large enough to allow multiple occupancy in streets around Mornington Crescent, and new residents moved in at a greater density. By the time of Charles Booth's Poverty Survey of 1889 there was a dramatic social divide between the Nash houses on Chester Terrace and the chronic poverty in Cumberland Market, immediately next door (Booth, 1902). Figure 2.1 shows Chester Terrace marked Yellow (Wealthy) – the wealthiest of Booth's classifications - and Cumberland Market streets to the east marked in darker colours denoting poorer categories, including Black (Lowest Class) – the poorest of Booths' classifications.

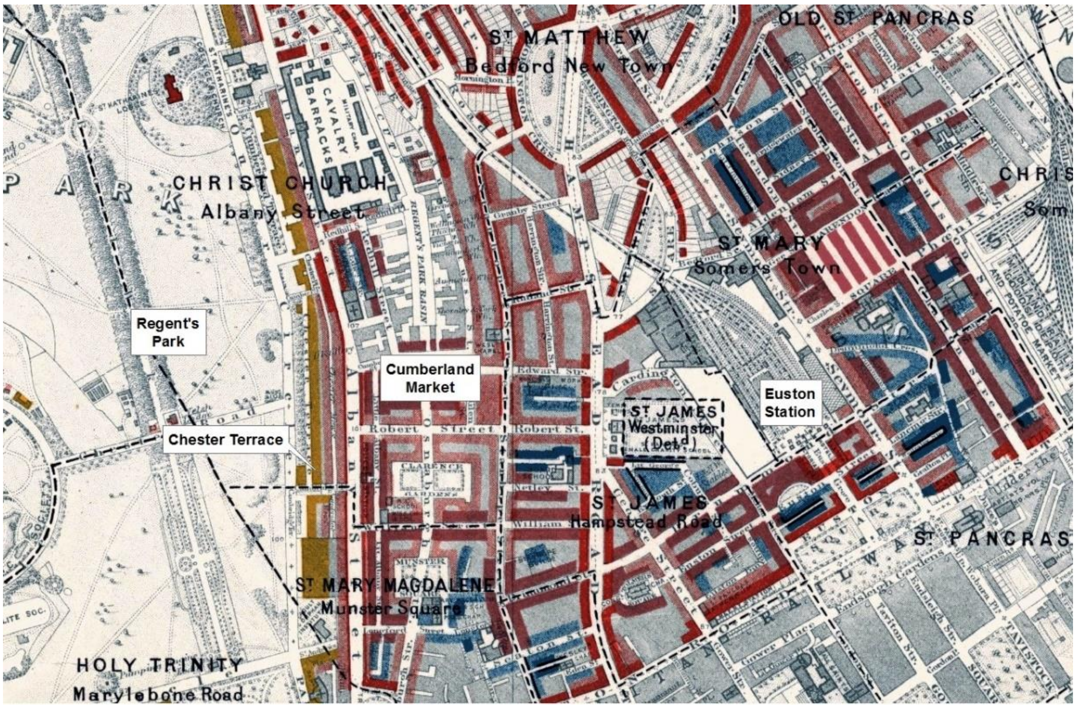

Figure 2.1: Chester Terrace and Cumberland Market (Booth, 1902).

The new railways were most visible where they were built on viaducts, notably in the east and south of Thames, to reduce the expense of demolition and road closures. Originally it was hoped that the railway arches could house middle-class homes and businesses, and that the roads alongside them could become fashionable. However, it soon became apparent that viaducts brought dirt, noise and vibration, and were seen to separate neighbourhoods (Dennis, 2008). Two demonstration houses were completed at the London Bridge viaduct at Deptford, one of which was let. Thomas observes that "what happened to the people who had to make way for the railway is not recorded, but they certainly did not go to live beneath it" (Thomas, 1972, p. 33). Railway infrastructure was seen as a "brutalising presence" in cities with the viaduct over Ludgate Hill, which cut across the view of St. Paul's Cathedral, seen by contemporaries as symbolic of the railway's effect on London (Olsen, 1976, p. 96) and by the end of the nineteenth century had become "unacceptable on environmental grounds" (Sutcliffe, 1982, p. 117). In Manchester, where railway viaducts were also built, land values increased by 75 per cent in 20 years, but remained unchanged near the Manchester South Junction viaduct (Kellett, 1969).

The conditions persisting in the worst inner London slums were a growing source of concern as the city grew exponentially during the Victorian era, enabled to a great extent by new transport routes. According to Stedman Jones, "it was intended that new streets should remove as much slum housing as possible" (Stedman Jones, 1971, p. 167). As late as the end of the nineteenth century London's final road scheme of the Victorian era, the construction of Kingsway and the Aldwych beginning in 1897 was both a traffic improvement scheme and a slum clearance project with the objective of demolishing the Clare Market slum, largely classified by Charles Booth as "Very Poor" shortly before it was cleared (Booth, 1902).

Official enquiries and legislation followed in the late nineteenth and early twentieth centuries, with the objective of clearing poor quality housing and replacing it with improved dwellings, but slum areas remained a long-term problem. In 1900 Alfred Smith, Head of the Housing Committee at the LCC described a "city teeming with slums and rookeries, the outcome of generations of apathy and neglect" (Polasky, 2001, p. 537). The perceived need to "clear congested areas" and to tackle the "slum problem" through "open layouts" was still being advocated in 1930 (Townroe, 1930, p. 112-3). The replacement of Victorian neighbourhoods and street layouts would continue after the Second World War with the introduction of modernist estate designs. To test whether the spatial connection between neighbourhood reconstruction and railway lines continued beyond the nineteenth century high point of railway construction, the twentieth century development of these areas needs to be assessed.

Spatial segregation and transport infrastructure

The building of new transport infrastructure has been linked by both Victorian and contemporary researchers to negative socio-economic consequences. Olsen quotes an anonymous 'Country Architect' writing in 1873 that "A line of railway passing through a vast city such as London causes incalculable evil: it not only defaces existing thoroughfares, but renders the creation of good new ones impracticable for all time" ('A Country Architect', Architect Vol. X, 1873, p. 14, quoted in Olsen, 1976, p. 299). According to Rodger, the railways “demolished properties and displaced residents, inflated land values and introduced physical barriers to mobility” (Rodger, 1995, p. 40).

Ginn argues that it was common in the late nineteenth century to observe that respectable people had little direct experience of poverty, indicating the segregated nature of much of London (Ginn, 2006). Cul-de-sacs and backwaters were closely associated with poverty, often created by infrastructure, including canals, docks, railways, gasworks, waterworks and new streets. Charles Booth’s poverty surveys regularly note the impact of such physical barriers, noting how in some districts poverty was “caught and held in successive railway loops” (Reeder, 1984, p. 7), while elsewhere the poor were to be found in small areas of streets between railways and canals, or beside gasworks, or in other neighbourhoods cut off from the city around them (Booth, 1902; Reeder, 1984). Edges and boundaries were associated with poverty in other contexts with Olsen arguing that the poor were forced to the borders of great estates, such as the Bedford and the Foundling Estates in Bloomsbury, as the priority for the estates was to “attract the wealthy” (Olsen, 1964, p. 206) by creating as attractive an environment as possible in their principal streets.

Figure 2.2: Descriptive map of London poverty 1889, showing East End, overlaid with axial local Integration (Vaughan *et al.*, 2005, p. 4).

Dyos (1982) notes that new railway lines sometimes impeded wider “improvement” of areas, by creating a physical barrier that prevented the reconfiguration of surrounding streets.

Vaughan, Clark, Sahbaz and Haklay's analysis of Charles Booth's social data shows that spatial segregation was indeed associated with the poorest streets in the East End of London, which were either surrounded by or separated behind better spatially integrated, wealthier streets. Figure 2.2 shows spatial analysis that demonstrates that better-off housing is more integrated locally and globally, while the poorest streets are separated from wealthier ones, by a buffer area of more mixed housing. Interruptions to the street grid created by physical boundaries seem to create areas with the conditions for poverty to thrive (Vaughan, Clark, Sahbaz and Haklay, 2005).

Kellett concluded that railway lines formed barriers that placed some areas "on the wrong side of the tracks", and created "shadow areas" of crossing lines "crystallising" dereliction (Kellett, 1969, p. 16). This research is concerned with understanding how far this is the case in London, whether it applies across terminals with different histories and infrastructure types, and whether these effects, observed in the nineteenth century, persist into the twenty-first, with spatial barriers fixing 'blight' in place over long periods of time.

Marginalisation in urban spaces

The spatial character of streets provides insight into the impact of urban interventions over time. Spatial research shows that areas of poverty in cities are shaped by a number of different forces, of which spatial configuration is one. Hillier writes that "Space does not direct events, but it does shape possibility" (Hillier, 2007, p. 155). While street networks do not determine the functions they contain, their accessibility can exclude certain types of movement and encourage others, therefore strongly influencing the nature of the space and the activity it contains. Spatial exclusion, or marginalisation, can be one of the results. Space can become "a strong contributory or initiating mechanism to social decline" (Hillier, 2007, p. 160). Hillier examined council estate layouts in London, and discovered that where they exclude the "natural movement" that leads to unconnected individuals being present in the same space, areas could become dominated by single groups. At the same time, areas that are badly integrated in this way can also be poorly linked beyond their boundaries, separated from the activity and facilities in nearby city streets. Research into links between spatial and social marginalisation helps to place a wider context around railway infrastructure in London, providing new ways of understanding the potential effects of terminals.

The term 'marginality' has become widely applied, used by disciplines including anthropology, archaeology, economics, ethnography, history, international development, planning, sociology and urban design. Each uses it, in different ways, to describe the separation of groups of people from mainstream social and economic life, and to provide a theoretical framework for analysing the consequences of such separation.

Marginality is a state defined by location at the periphery, whether conceptually or literally, resulting in social, cultural, political and economic weakness (Bailly, Jensen-Butler and Leontidou, 1996). Physical marginalisation, or spatial separation, has been implicated as “a force in the rise and reinforcement of socioeconomic inequality” and has, according to some, been active from the first formation of human social structures (Arnold, 1995. p. 1). Nightingale’s global history of segregation traces the phenomenon back 70,000 years (Nightingale, 2012). Spatial marginalisation provides a unifying, underlying concept of disadvantage with application across global societies, from dense urban to remote rural (Gurung and Kollmair, 2005). Spatial marginalisation is seen as a problem of access to infrastructure and services, created by remoteness from their location and lack of means to reach them, or by the existence of physical or cultural barriers to do so.

Spatial and social marginality are connected through a dynamic process of mutual influence. Spatial marginality is linked to many other forms of marginality, manifested as various, overlapping types of inequality, including cultural, economic, ethnic, political and social disparities. It is recognised by economists as a “socially constructed inequitable non-market force of mini bias”, operating separately or alongside the market forces that are generated by the operation of economic systems (Mehretu, Pigozzi and Sommers, 2000, p. 89). However, spatial and social segregation are not inherently the same, with individuals not physically restricted to the places where they live, but likely to move around a variety of locations for work and social activities, meaning their social encounters are not necessarily comparably segregated. As Netto points out “space is taken as a surrogate for social distance”, but in fact “social and spatial distance may be intertwined in more subtle and complex ways” (Netto, 2016, pp. 21-22). Any investigation of segregation therefore needs to avoid conflating the two.

Researchers have argued that post-industrial economic restructuring and change in cities has taken a role in creating new types “spatial, social and socio-spatial marginalisation” (Bailly *et al.*, 1996, p. 174). According to Vaughan, “segregation acts as a political agent above all, assisted by popular support and sustained by the land and economic markets which benefit from it” (Vaughan, 2012, p. 1). The connection between spatial marginality and certain forms of disparity is contested, with Castells describing as the “myth of marginality” the assumption that physical separation necessarily leads to “deviance” from the political or social mainstream (Castells, 1983, p. 175). However, Sassen identifies a new geography of “centrality and marginality” as a defining feature of a globalised economy, with urbanised areas hosting both centres of high and low income in close proximity (Sassen, 2000, p. 124). This creates polarisation and marginalisation within cities, not simply on its edges.

Marginalisation has been described as “a socio-spatial phenomenon” (Franzén, 2009). Parità and Versluis describe marginality, like centrality, as “a process” with boundaries and fringe areas changing over time (Parità and Versluis, 2014, p. 003). Spatial connectivity has been shown to be closely associated with the social functioning of cities. It has been suggested by Hillier and Hanson that the “co-presence” of people from a variety of social contexts in public spaces is a basic social function of a city (Hillier and Hanson, 1984). Co-presence in itself can be seen as a social resource with a “significant effect on life chances” (Legeby 2013, p. 4). Amin and Graham suggest that multiple spaces are necessary for an “open city” (Amin and Graham 1997), and social interaction in public spaces can act as “sources of social renewal, economic innovation and creativity” (Iossifova, 2013, p. 4). Public spaces provide sites for measuring marginality, and a bellwether for spatial segregation. However, while marginalisation within cities cannot be understood without analysis of spatial segregation, research also needs to investigate the dynamic interactions between social, economic and physical factors that lead to separation and Integration (Charalambous and Hadjichristos, 2011).

However, marginalisation cannot be characterised simply a negative force, resulting only in places that lack movement, activity and connection with the city. Sennett believes shared public space can be in fact be specifically found at the “borders, or edges, between any two communities – whether differentiated racially, in terms of wealth or in terms of their programmatic focus” (Sennett, 2006, pp. 86-87).

Borders offer the possibility of inclusion as well as exclusion (Newman, 2003), while the ghetto has been shown to provide a basis for a strong immigrant community to develop close to its potential markets and make the connections that form the basis for Integration (Vaughan, 2005). Segregation, although never voluntary according to Nightingale (2012), can be a necessary spatial quality for the accommodation of the marginal as a component of the city. Imai assesses urban borderlands as “voids and scars”, but also as “essential spaces of temporary and informal use” that emerge with the evolution of cities (Imai, 2013). Vaughan suggests that segregated urban areas, such as the historical ghetto, can function as part of a city. The combination of a segregated area and street grid enables an “intense layering of activities” (Vaughan 2005, p. 2), and smaller block sizes allow areas such as London’s Soho to host socially marginal activities “which can coexist with the contrasting surrounding areas by virtue of the spatial containment of the district” (Vaughan, 2005, p. 9).

Marginalisation is linked to the existence and nature of borders or boundaries. In cities, borderlands can separate “old and new, modern and traditional, rich and poor, planned and organic, formal and informal, permanent and temporary, local and migrant” not only at the edges of cities but also within them (Iossifova, 2013, p. 2). Iossifova makes the case that borderlands are not in-between places, but instead are themselves “spaces of exclusion” connecting socioeconomic marginalisation directly to the physical spaces that host and define it (Iossifova, 2013, p. 2). This concept has been expressed by Yiftachel as the idea of “gray [sic] space”. He identifies a category of physical location “between the ‘whiteness’ of legality/approval/safety, and the ‘blackness’ of eviction/destruction/death”, a space occupied by socially and economically marginalised people (Yiftachel, 2009, p. 89). While this concept was developed to describe informal settlements, excluded from legitimacy by formal planning systems, it is also relevant to discussion of urban borderlands within developed cities such as London.

Spatial segregation and infrastructure

The concept of spatial marginalisation is a tool for understanding the spatial, social and economic role played by railway infrastructure in London over time, and by the presence of a greater number of railway terminals than in any other city. The building of new infrastructure of all types in London is linked by both Victorian and contemporary researchers to spatial segregation. Ginn argues that it was common in the late nineteenth century to observe that respectable people had little direct experience of poverty, indicating its segregated nature in London (Ginn, 2006). Within the East End, areas of particular isolation were closely associated with poverty and were often created by infrastructure, including canals, docks, railways, gasworks, waterworks and new streets. Edges and boundaries were associated with poverty in other contexts with the poor were forced to the borders of great estates, such as the Bedford and the Foundling Estates in Bloomsbury, as the priority for the estates was to “attract the wealthy” (Olsen, 1964, p. 206) by creating as attractive an environment as possible in their principal streets. These edge areas can be linked to Yiftachel’s concept of grey space, lying outside formally planned estates and street grids, vulnerable to major physical alteration over time as industrial and infrastructure requirements change.

Dyos (1982) notes that new railway lines sometimes impeded wider ‘improvement’ of areas, by creating a physical barrier that prevented the reconfiguration of surrounding streets. Vaughan *et al.*’s analysis of Charles Booth’s social data shows that the poorest streets in the East End of London were spatially segregated, either surrounded by better spatially integrated, more wealthy streets or separated by them. Spatial analysis demonstrates that the better-off housing was more integrated locally and globally, while the poorest streets are separated from wealthier ones by a buffer area of more mixed housing. Interruptions to the street grid by physical boundaries seem to create areas with the conditions for poverty to thrive (Vaughan *et al.*, 2005).

Marginalisation is also cited as a consequence of the revival of public transport systems in post-industrial cities over the past twenty years. Bailly *et al.* suggest that the post-industrial development of public transport systems in cities, with inevitable economic redistributive effects, is a prime example of an under-examined process likely to create marginalisation effects (Bailly *et al.*, 1996). Docherty has called for further thinking and analysis to assess “how the meaning of central railway stations (and their surrounding neighbourhoods) as places is affected by their redevelopment, reorientation towards international commercial uses and reimaging as cutting-edge business locations” (Docherty, 2000, p. 1465). The relationship spatial marginalisation and London’s terminals today has been proposed as an area requiring further research by Hillier, who writes that more research is needed to understand the effect of railway terminals in creating concentrated movement along entrance routes, and corresponding areas where movement is lacking (Hillier *et al.*, 1993).

Morphology of London railway neighbourhoods

The original setting for each of London’s rail terminals differs from station to station. However, several were built on what was, at the time of construction, the edge of built-up London, an area type that matches the morphological ‘fringe belt’ classification developed by Conzen (1960). Whitehand describes fringe belt areas as characterised by their heterogeneity, but also by elements of urban morphology which reflect uses best suited to peripheral locations (Whitehand, 1967). Whitehand notes that “it is striking that fringe belts retain their distinctiveness long after they cease to be at the actual fringe of the built-up area” (Whitehand, 1967, p. 231). The identification of forms that are resistant to morphological change reflects the status of the railway terminus in the city, and the edge setting of new terminals places many of London’s terminals in fringe belt contexts. The identification of railway stations and structures within this area of historical geography suggest methods of investigation. Whitehand, interpreting Conzen (1988), describes a threefold approach to analysing morphological units: identifying their resistance to change, their historico-morphological characteristics and their place within the hierarchy of units (Whitehand, 2007). Later work by Conzen has defined different types of urban fringe belt, including the inner urban fringe belt. While the need for further research is acknowledged, this concept is shown to include cities with a historical core surrounded by, amongst other boundaries, infrastructure such as railway yards and canals (Conzen, 2009).

Larkham (2006) identified potential complementarity between Conzenian morphology and space syntax analysis in the study of urban form. Subsequently, this combination of analysis techniques is applied by Griffiths, Jones, Vaughan and Haklay (2010) and by Hallowell and Baran (2013) to analyse urban configuration over long periods of time, relating the form and spatial character of a place to changes in buildings and land use at different scales.

Railway displacement

Despite moves to manage "railway mania" it is estimated that as many as 4 million people were displaced by railway construction across Britain during the second half of the nineteenth century (Waller, 1983). The Royal Commission on the Housing of the Working Classes, reporting in 1885, concluded that the main purposes of slum clearance and demolition was to benefit property owners by improving the value of their land holdings (Royal Commission, 1885). The Commission particularly blamed the road improvement schemes carried out by the Metropolitan Board of Works, and railway construction (Olsen, 1964).

The growing labour market in London was fuelled by increasing numbers of unskilled workers as the nineteenth century progressed. They were obliged to seek casual employment, and to group the limited areas of central London where they could be physically close to sources of casual labour, and could afford to live (Wohl, 1977). In 1880, it was still possible to claim that the majority of working men in London lived "in Whitechapel, in Westminster and in Drury Lane" (Ritchie, 1880, p. 117).

Demolishing slums inevitably reduced the amount of cheap housing available in central London, and made overcrowding worse through higher rents caused by reduced supply. Slums housed people who were trapped economically below the subsistence line and physically, unable to afford to live anywhere else. Those displaced were likely to be forced to live nearby in more crowded accommodation (Olsen, 1964). Railways and other transport improvements had the effect of increasing property values and rents permanently, so displacement was social as well as physical (Reeder, 1984). The poor were also feared as a potential source of political unrest, providing additional motivation for the dispersal of concentrated areas of poverty in central London, close to institutions and seats of power (Reeder, 1984).

Population displacement generated the need for new solutions to the problems created by workers being forced to live further from their jobs (Reeder, 1984). The first systematic attempts to rehouse displaced slum dwellers came only late in the nineteenth century, with the construction of Charing Cross Road and Shaftesbury Avenue. Parliament had already decided that railway companies should not be required to replace housing demolished for the Great Eastern extension from Bishopsgate to Liverpool Street, in the mid-1860s, and had instead granted permission for the demolitions to go ahead in exchange for cheaper fares for workmen on suburban trains. Workmen's fares meant that, for the first time, workers could live outside Central London and commute to and from work every day. However, they were restricted primarily to railway companies serving North East and East London, and their geographical restriction reinforced social segregation with unskilled workers only able to live on a limited number of routes (Polasky, 2001).

Displacement also generated a "ripple effect" according to Booth, also identified by Vaughan in the East End (Booth, 1902; Vaughan, 2007). This effect, frequently discussed, is said to have led to the inhabitants of poorer areas, rather than dispersing, relocating in groups. Where possible, they moved to streets close to their demolished houses, with the result that slum clearance simply moved poorer people around a slightly larger area. For example, the clearance of the Clare Market slum from 1897, including the courts between the Strand and Kingsway, was thought to have caused a significant proportion of its former inhabitants to relocate to Notting Dale (Townroe, 1930). The ripple effect was well-enough known to feature in popular fiction (Galsworthy, 1928). The exclusion of previous tenants was reinforced by the policy adopted where replacement housing was built, such as at the LCC's first estate at Boundary Street. The flats that replaced the Old Nichol slum required residents to meet a minimum income, as well as standards of behaviour and cleanliness (Fisher, 1905). There was a general belief that not only did slum residents not want to live in the type of new housing on offer, but that if they did they would "soon reduce them to an abominable condition" (Townroe, 1930, p. 42). Instead, the condition of areas around those cleared was reduced instead, effecting the wider neighbourhood.

However, despite the scale of these interventions they "failed to substantially alter the geography of poverty" in London (Orford, Dorling, Mitchell, Shaw and Smith, 2002, p. 34) with significant continuity between the spatial distribution of poverty in twenty-first century

London and in the areas surveyed by Booth. Slum clearance removed housing stock, but did not necessarily improve the circumstances of those still living in cleared locations. The social and economic conditions found in London one hundred years ago remained a strong predictor of mortality in the 1990s (Orford *et al.*, 2002). The principle that those in poverty should move, in their own interests, away from concentrations in inner London was still current enough in 1992 for Rogers to specifically rebut it as a potential solution to London's late twentieth century urban decay (Rogers and Fisher, 1992).

A substantial literature examines the historical processes that led to the creation of the Victorian railway system, on which our current rail infrastructure is based, and the decisions that lead to the siting of London terminals. The social and economic rationale for these decisions is also examined historically, but their modern legacy has been subject to more limited investigation. The dual purposes of Victorian infrastructure planning, in providing a tool to modernise London as well as to equip it with new systems, have left long-term infrastructures in place. There is a need for research to place twenty-first century railway development within the long-term story of the creation of railway neighbourhoods from the mid-nineteenth century onwards, to assess the extent to which parts of the modern city are still shaped by their origins. There is also the potential to study the extent to which continuity can be found between Victorian and modern discourse on the redevelopment of railway stations and their neighbourhoods. London railway terminus neighbourhoods offer a potentially fruitful area of study because of their unusually large number and their continuing location at the edge of the modern inner capital, areas that are relatively unresolved in terms of their morphology, their connection to London's Central Business District, and their future role in relation to competing development priorities.

Space syntax, housing and infrastructure

Space syntax analysis is a central technique of analysis in this thesis, based on its use by researchers to interrogate the historical development of cities and the long-term impact of infrastructural change. The application of space syntax analysis to historical and geographical research questions has been critiqued as being applicable only to direct studies of spatial concepts themselves rather than of their effects (Griffiths, 2012). However, the spatial effect of the introduction and continued presence of large-scale railway infrastructure in London requires spatial measures that can quantify apparently subjective phenomena.

Griffiths demonstrates that different scales of analysis of a chosen street can reveal multiple layers of spatial description, co-existing within the history of a single place and calls for "an improved method of describing urban space" (Griffiths, 2012, p. 2). The spatial qualities of industrial revolution era cities have been conceptualised as problems, rather than analysed as places. He suggests the need for "spatially sensitive historical contexts" to redress this imbalance (Griffiths, 2005, p. 655). The use of space syntax alongside historical and mapping techniques provides further layers of description and understanding which add to the information available to evaluate urban change over time.

Space and historical research

The central theory of space syntax is that space has a formal logic that precedes social logic, and that because space forms an intrinsic element of everything that people do, this formal logic generates social activity. Hillier and Hanson's theory of space and society proposes that individuals relate to wider social groups both through "correspondence" between their "social identities" and the "spatial zones" they occupy, and also through "structured non-correspondence", a term describing networks that are not primarily defined by space (Hanson and Hillier, 1987).

Hillier and Vaughan (2007) suggest that, despite the city appearing to be both physical, with buildings linked by space, and social, with people linked by interaction, physical interventions treat the city as though it were a single physical system. Theories about how the physical and social interact determine major urban design decisions, but these propositions change dramatically over time and are rarely, if ever, scientifically tested.

Hillier *et al.* (1993) propose that space syntax analysis, revealing as it does the natural movement generated by spatial configuration, can play an important role in helping those engaged in various forms of historical urban analysis understand the social impact of many layers of urban design and change. Analysing spatial configuration (the relations between all parts of a spatial system) makes it possible to test how social factors may have influenced the construction of spatial patterns (Hillier and Vaughan, 2007 in Vaughan, 2007).

Hanson (1989) describes design as using formal "order concepts" to organise information, ordering the reality of buildings and places. The relations between parts and the whole in a place make it intelligible, but order is distinguished from structure, with structure explained as the way people experience places without the benefit of a plan view. Hanson (2000) applies space syntax to extract "design paradigms" from historical built form, and to trace shifts in paradigms over time. Cities such as London, which look different to 'planned cities', can be shown using spatial analysis to be well-structured despite not appearing ordered. Order does not guarantee structure, nor lack of order chaos. However, Hanson proposes that cities need to be understood using both concepts, allowing the supposed distinction between a “natural” and an “artificial” city to be dismantled (Hanson, 1989).

Space can be used either to segregate, or to generate new relations through Integration bringing people together. There are dual processes involved in the creation of cities: a public space process, maximising movement and co-presence and a residential space process, restricting and structuring movement. These processes appear to be almost universal, across cultures: all cities have busy and quiet places in close proximity (Hillier and Vaughan, 2007). These are important theories for investigating whether the separation and segregation effects associated with railway terminals can be identified in practice. While more activity would be expected in more accessible main streets, and less in smaller back streets, larger areas of separation in city centres are atypical. If areas behind terminals are shown to be more separated as a whole than areas in front of stations, it may be possible to suggest that railways prevent areas of the city from being spatially connected and, therefore, equipped to attract the activity levels associated with central London.

The spatial characteristics of poverty

Space syntax analysis techniques have been used to identify spatial characteristics associated with poverty in late nineteenth century London, and to represent them separately from the social causes of poverty, traditionally the predominant focus of both historical and urban research. Orford *et al.* (2002) produced an early study applying spatial analysis to the poverty maps of London produced by Charles Booth. Orford *et al.* link measures of class to contemporary ward boundaries in London, and compare them to measures of class in the 1991 census and mortality rates from 1991 to 1995. Social class is used as a proxy for poverty, as it was by Booth.

The geography of poverty is also similar between the two surveys, with fewer very rich and very poor households and overall, a slightly poorer average. Overall comparisons of the proportion of households in each social class show only a slight change between 1898 and 1991, with slightly more wealthy people overall and 10 per cent fewer people in poverty in London (Orford *et al.*, 2002). Orford *et al.* show that in 1991 poverty was still concentrated in the East of London, with isolated areas of poverty in the West showing direct continuity with Charles Booth’s survey. Across the survey area, 46 per cent of wards had not changed their relative position by 1991. Overall 75 per cent of wards in the richest category stayed the same, while 45 per cent of the poorest moved up in category. Wholesale changes of position for entire neighbourhoods have proved very rare (Orford *et al.*, 2002, p. 34).

Charles Booth's surveys of poverty in London took place during a time when poverty had reached a critical point in London, well-documented but exaggerated rather than analysed. Vaughan (2007) shows that the East End and Soho, notorious areas of nineteenth century poverty, show common spatial characteristics, with both poorly connected to main roads. Physical barriers are highlighted by Booth as important factors in adding to spatial segregation.

However, Vaughan also shows that segregation and poverty are connected in particular ways. Spatial analysis of the East End shows that the most segregated areas are light blue in Booth's classification – standard poverty – rather than the two poorest categories. The poorest areas may be less segregated because they tended to be located in areas that had once been prosperous but had fallen on hard times.

Vaughan *et al.* (2005) have applied spatial analysis of historical maps to a wider areas of the East End, using Booth's two London-wide poverty maps (1889 and 1898). Overlaying spatial Integration values on Booth's social data shows that the poorest streets were spatially segregated, either surrounded by or located behind better integrated, better-off streets. Higher-class streets "seem to form the skeletal structure of the system" (Vaughan *et al.*, 2005, p. 4). However, these main streets are not well-connected globally to the rest of London, so the area as a whole is relatively isolated. Interruptions to the grid are often created by physical boundaries, which correspond to areas of poverty.

The East End streets classified as 'Middle-Class' are more locally and globally integrated than others, and Vaughan *et al.* hypothesise that these locations reflect the economic needs of people who worked in trade and crafts which required footfall to generate income. 'Purple' streets, containing a mixture of poor and better-off people, separate the poorest streets from wealthier ones, acting both as a buffer and transition point. Socially marginalised people are shown to follow distinctive patterns of settlement which are spatially influenced, as revealed by Booth map data and analysis of the Integration of street segments (the section of a street between two junctions). Local spatial forces are shown to influence the transformation of the East End of London.

Spatial analysis of social housing in London

Spatial analysis has been applied by various researchers to investigate the spatial configurations created by housing interventions designed to alleviate poverty in London. The Artisans and Labourers Dwelling Act (the Cross Act) of 1875 paved the way for slum clearance and for philanthropic housing schemes. However, these were often built in a way that reinforced spatial segregation, with inward-facing blocks and dwellings facing away from the street (Vaughan, 2007).

Hanson has identified an “inward-facing morphology” (Hanson, 2000, p. 100) dating back to Henry Roberts' Model Housing for Families' on Streatham Street, built in 1847. This is part of what is termed a “hard solution” (Hanson, 2000, p. 101) used in twentieth century housing policy, both spatially concentrating and separating people at the same time. To validate this theory, Hanson has applied spatial analysis to the typologies of housing introduced by the London County Council (LCC) during its slum clearance programme. She shows that the replacement of the Old Nichol slum with the first model LCC estate, Arnold Circus, in 1900 inverted the spatial characteristics of the pre-existing street network, including channelling movement by reducing Choice. This created open space that was visually simpler and apparently easier to navigate, but in fact more controlled. The rebuilt area is therefore less susceptible to local, incremental change. Spaces act as a filter for activities, with people separated and random events, such as encounters, avoided (Hanson, 2000).

Hanson also applies spatial analysis through a case study of the railway neighbourhood of Somers Town, located behind St. Pancras Station. The new houses at Somers Town and the Polygon began construction in the 1780s, but were not popular with their intended middle class market, becoming squeezed between St. Pancras and Euston Stations, and were sold in smaller plots to builders aiming further down-market. Poverty became a particular concern, and the first model dwellings intended to improve conditions were built the by Metropolitan Association for Improving the Dwellings of the Industrious Classes in 1848. Slum clearance was begun in 1901 by the London County Council, and 1906 by St. Pancras Council. Somers Town is now a landscape of social housing typologies, with examples from each decade of the twentieth century. Figures 2.3 and 2.4 illustrate the extent of change to the street grid that resulted, with “fewer and large islands, formed by the amalgamation of adjacent urban blocks” causing the area to become “more cut-off” (Hanson, 2000, p. 105).

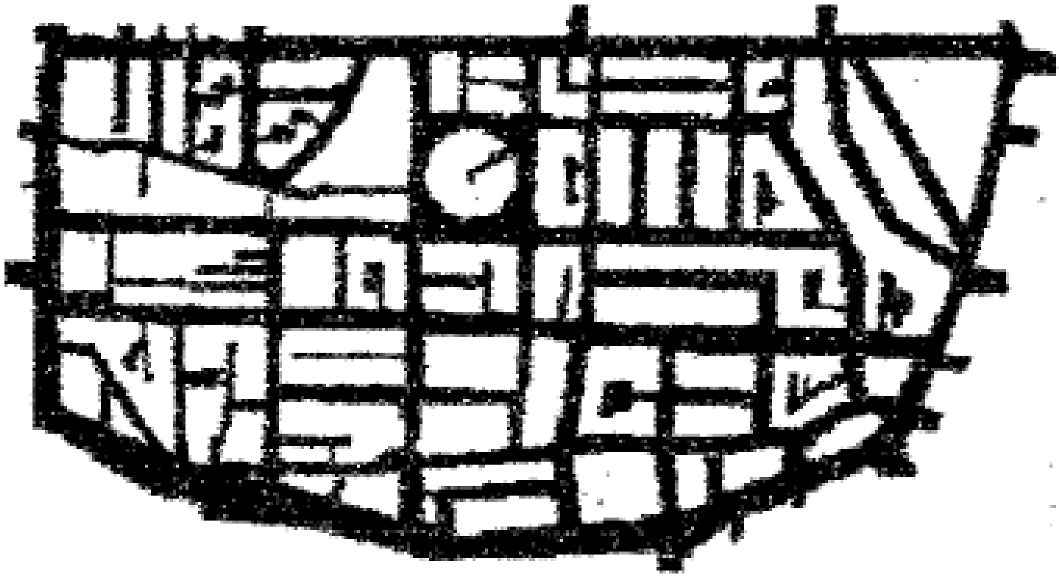

Figure 2.3: Open-space map of Somers Town in the late nineteenth century (Hanson, 2000, p. 105).

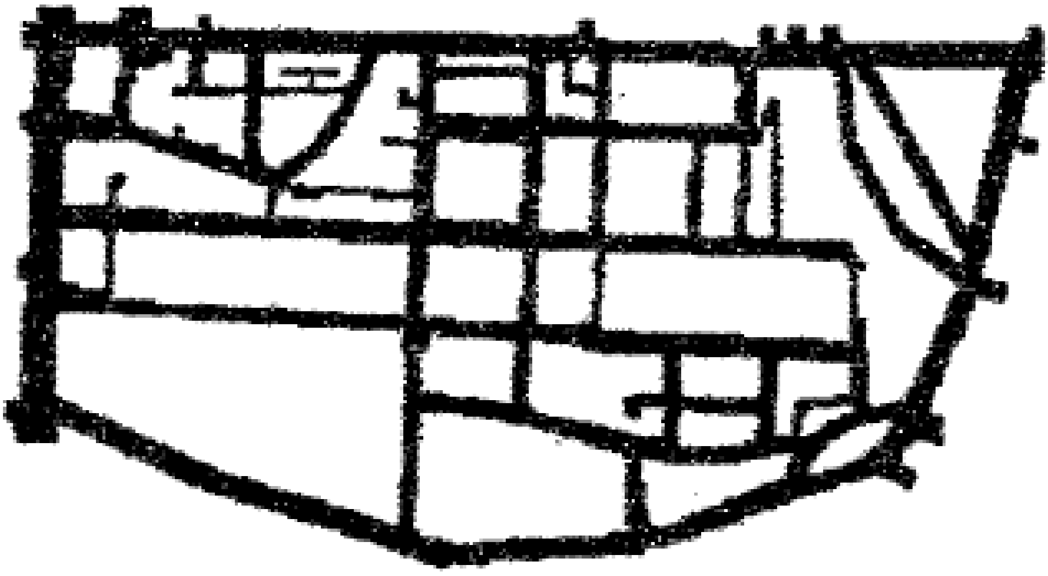

Figure 2.4: Open-space map of Somers Town in the late twentieth century (Hanson, 2000, p. 105).

Vaughan *et al.* (2005) also analyse the spatial configuration of blocks, looking at the late nineteenth century East End of London. They measure the angle of each block in their study area to its neighbours, and use these data to compare blocks forming different streets with each other. This shows that half the middle-class streets are connected to each other and another third to classifications above; meanwhile more than a third of the poorest streets are connected to each other.

Spatial segregation becomes a social problem when it becomes extreme, and loses cultural form. Hillier *et al.* (1993) identify segregated housing estate blocks around King's Cross and St. Pancras Stations. This theory has been tested in relation to the Maiden Lane Estate behind King's Cross Station, which is structurally segregated with segments that are much shorter than in surrounding streets and a lack of internal structure. A 10:1 ratio of adults to children in nearby streets contrasted with a 4:1 ratio of children to adults on the estate, with adults and children using separate spaces and natural surveillance absent, a problem also found on other London estates (Hillier and Vaughan, 2007 in Vaughan, 2007). As Vaughan noted "the nature of the new housing form was to create deeper, more labyrinthine layouts which cut off the inhabitants from the everyday life of the streets" (Vaughan, 2005, p. 2).

Spatial analysis of London railway stations

Space syntax analysis has been used to explore the spatial context of London railway stations in studies from the 1990s onwards. Paksukcharern (2003) takes as her starting point Bertolini's "node-place" theory, that significant transport 'nodes' are rarely also "significant places" in cities (Bertolini, 1996). Paksukcharern argues that the 'node-place' problem is fundamentally a spatial one. Hillier's theories of the formation of vibrant urban places through natural movement inform spatial analysis of the influence of movement on land use patterns and on centre formation at ten London railway terminals.

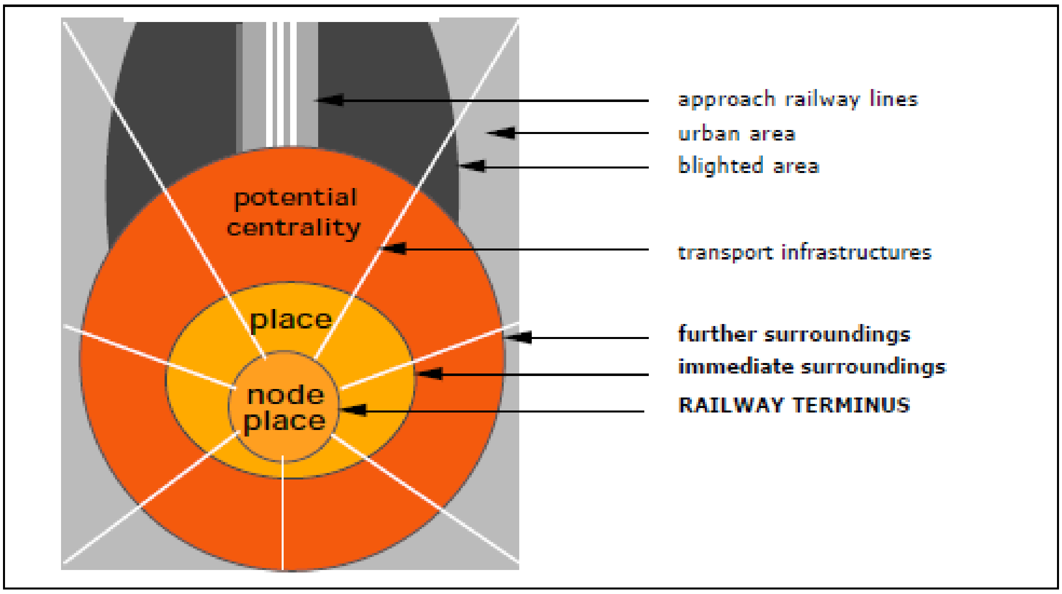

Figure 2.5: Model of node-place synergy in railway terminus areas (Paksukcharern, 2003, p. 361)

Paksukcharern argues that redesigning transport nodes to function as "pedestrian nodes" is a complex design task with terminals often scarred by railway structures, wasteland and "blighted" neighbourhoods. Her own version of the "node-place" model, shown in Figure 2.5, defines areas as immediately alongside the approaches to London terminals as "blighted". Her findings support the argument that spatial configuration is the key to creating places from "nodes", and that to do so spaces inside and outside terminals need to be integrated into local systems of pedestrian movement. A node becomes a "place" when it is a "configurational attractor" in the local network. Her ideas have been applied to case study locations in the Netherlands, concluding that designing "economically dense" environments around railway stations requires the station to be integrated with local movement structures (Mulders-Kusumo, 2005, p. 209).

Other researchers apply an entirely station-focused perspective, treating stations as the determining factor in the planning of surrounding land use and directing movement, for example Li and Hsieh (Li and Hsieh, 2014). However, Paksukcharern is concerned with the unacknowledged impact of stations on natural movement in their neighbourhood. Studies that examine the spatial configuration of the wider areas around stations, particularly those impacted on by railway infrastructure or by 'blight', are rare. The main work on this subject is the case study by Hillier *et al.* (1993) of the urban configuration around the King's Cross Station 'railway lands', commissioned to inform redevelopment proposals. Using axial analysis, the study defines areas of denser "grid-Integration" to the west and south, and of sparser "line-Integration" (Hillier *et al.*, 1993, p. 41) corresponding to areas of high and of low pedestrian movement.

The connection between spatial segregation and poverty is consistently documented, especially in London, and spatial analysis techniques offer an approach that allows the weight of historical development processes to be applied to an understanding of the city today. Multiple layers of change require equivalent layers of description, and the incremental creation of places can be unpicked using this approach. The development of railway terminals within a dense urban street network has obvious spatial implications, and the extent to which segregation is associated with railway structures is under-researched. Assumptions about the nature of any effects, and in particular the 'blight' associated with stations, is a central topic for this research. The connection between the presence of a large station and a consequent effect on movement networks, with street located behind stations less accessible than those in front, has been suggested by Hillier *et al.* (1993). This thesis tests how far this effect can be detected in a selection of London terminals. It also tests whether effects that equate to blight can be detected and, if so, in which types of location.

Railway redevelopment research

The spatial relationship between railway terminals and their surrounding areas, and the socio-economic effects often associated with their presence, are particularly current concerns in the context of the renewed role played by railways in London and other global cities. The revival of city centres in Western Europe and the USA from the end of the twentieth century led not only to renewed investment in railways, but also to the re-development of large stations themselves, with associated rethinking of the role played by terminals in particular cities. Railway terminals have been altered, extended and redeveloped resulting in new research into the role that they play in relation to their surroundings. Researchers have reconceptualised stations, and terminals in particular as centres. Transport orientated development approaches cast the railway station as a generator of place, while research has also suggested that the role of the station as a place rather than simply a functional transport node has been overlooked, to the detriment of stations and their surroundings.

In London this reappraisal has focused on the reconceptualisation of terminals as providers of retail space, and on the redevelopment opportunities created in their immediate neighbourhoods by refurbishment and expansion. While perceptions of the relationship between terminals and their surrounding neighbourhoods have shifted, but they remain focused on stations rather than the places to which they belong. A review of the literature on contemporary railway thinking demonstrates how the wider station neighbourhoods remain, despite new concepts of the station, in the shadows.

Railway renaissance

The literature on the redevelopment of railway stations in Western Europe and the USA has grown in line with what has been characterised as “The Second Railway Age” (Hall and Banister, 1994). New high speed rail lines are proposed in Britain, the latest phase in the steady growth of high speed rail in Europe. A high speed station has become *de rigeur* for ambitious, competitive cities, and this new era of rail upgrades has brought a new level of attention to the previously neglected areas surrounding railway stations. It has also brought large-scale investment to city centres, giving rise to debate and even conflict over social as well as physical change.

Over the past 40 years the larger cities of Western Europe and the USA have progressed from post-industrial decline to city centre reinvestment and redevelopment, resulting in the revival of urban locations as sites of economic activity. After the Second World War manufacturing industries and their associated supply chains and infrastructure left city centres and re-located, if at all, in peripheral locations. The role of the rail terminus in London changed with the closure of the enormous goods stations and yards which had flourished since the nineteenth century (Freeman, 1999), and the railways became for the first time predominantly a passenger service. Large areas of disused buildings and land stood empty in traditionally less valuable areas of cities, but from the 1980s these began to acquire new value as sites for potential redevelopment.

During the late 1990s this growing focus on property development in urban centres began to coincide with a revival in rail transport, which had experienced a period of decline in parallel with that of city centres, as car travel became the default mode of transport and cities were designed predominantly to accommodate mass car use. Peters and Novy (2012a) identify three phases of railway development: the “Railway Age” from the later 1800s to the mid-twentieth century when railways played an important part in industrialisation; their neglect and decline after the Second World War, when the car was king; and the “Railway Renaissance”, as post-industrial city centres were “rediscovered as attractive sites for working, living, visiting and entertainment” (Peters and Novy, 2012a p. 6).

Other developing twenty-first century urban policy agendas have had a significant impact on railway station development. During the 2000s national and local governments began to adopt transport planning approaches designed to promote the environmental and social sustainability objectives newly embodied in public transport, walking and cycling (Bertolini, Curtis and Renne, 2012). This has coincided with the availability of city centre sites, often adjacent to railway stations on sites that previously housed distribution facilities and other industries, which has allowing urban development designed to densify working and residential populations and support different transport modes. In London, a new planning strategy was adopted in the early 2000s, with the objective of developing the tallest buildings and the highest densities in the city at major transport nodes, prioritising railway terminals (Mayor of London, 2004).

Over the 1990s and 2000s further trends added impetus to the development of station areas. High speed rail travel in Western Europe has made travel between cities much more competitive, particularly in comparison to domestic flights. Rail privatisation, which occurred across Western Europe in the 1990s, changed the attitude of rail companies towards their land holdings and led to a new interest in generating income from property assets. A more globally connected economy has generated new competition between cities, as businesses become more mobile and cities seek to draw in economic activity. The result has been that "railway stations are not considered merely as nodes, where people change from one form of transport to another, but also as places where spatial concentrations of high value activity are recognised as having a positive impact on cities" (Bruinsma al., 2008, p. 2). However, Hall suggests that new high speed networks may "favour the large central cities they connect, especially their urban cores, and this may threaten the position of more peripheral cities" (Hall, 2009, p. 59). Connectivity may have spatially distorted impacts at regional scale, but the same may be true at intra-city scale, with central areas benefiting from greater accessibility but peripheral areas suffering disbenefit.

Rail mega-projects and conflict

Peters and Novy (2012a) describe a new era of "rail station mega-redevelopment projects" (Peters and Novy, 2012a p. 5), with examples to be found in every major city in Europe during the second half of the 2000s. Their origin is traced by Bertolini, Curtis and Renne (2012) to the 1990s when, following the limited success of attempts during the 1980s to capitalise on railway property, "urban mega-projects" arrived at locations such as Lille in France, in the new context of changing city economies and of high-speed rail.

However, during the 2000s the concept of Transit-Oriented Development (TOD) (Calthorpe, 1993), originating in the USA, characterised a shift away from major urban projects towards the development of stations themselves into hubs for multiple modes of public transport, and for regional transport networks. European governments have moved towards promoting large-scale redevelopment projects based around stations, typically with a mixture of office, leisure, retail and housing, as a means of improving the attractiveness of whole cities to business. Stations have become "the preferred places for urban developments" (Bertolini, Curtis and Renne, 2012 p. 32).

As Peters and Novy (2012a and 2012b) point out, the creation of value through railway station projects is frequently contested. They comment that "scholars are conscious and critical of the equity implications of the schemes in question, worrying, inter alia, about inner-urban gentrification and the selective privileging of 'premium infrastructural configurations'" (Peters and Novy, 2012b p. 15). Brenner critiques the "recalled configurations of state spatiality" which, as politicised decisions intended to shape national economies have, he believes, "generated new forms of socio-spatial inequality" (Brenner, 2004, p. 481).

Privately-owned rail companies seek to commercialise their main advantage, which is the accessibility of their sites. Their approaches have progressed from selling land around stations and renting out the space within them, to providing services to "everyone who uses the station areas for travelling, living, working, learning, shopping, eating and drinking", the stated objective of Netherlandse Spoorwegen, the former state rail company in the Netherlands (Bertolini, Curtis and Renne, 2012, p. 33). With European rail companies increasingly earning revenue from commercial rents as much as from ticket sales, railway station development has increased in commercial significance, from a side-line activity to a central business objective. Bertolini, Curtis and Renne (2012) note the potential conflict between priorities within railway companies, to maximise returns from property as well as to provide services to customers.

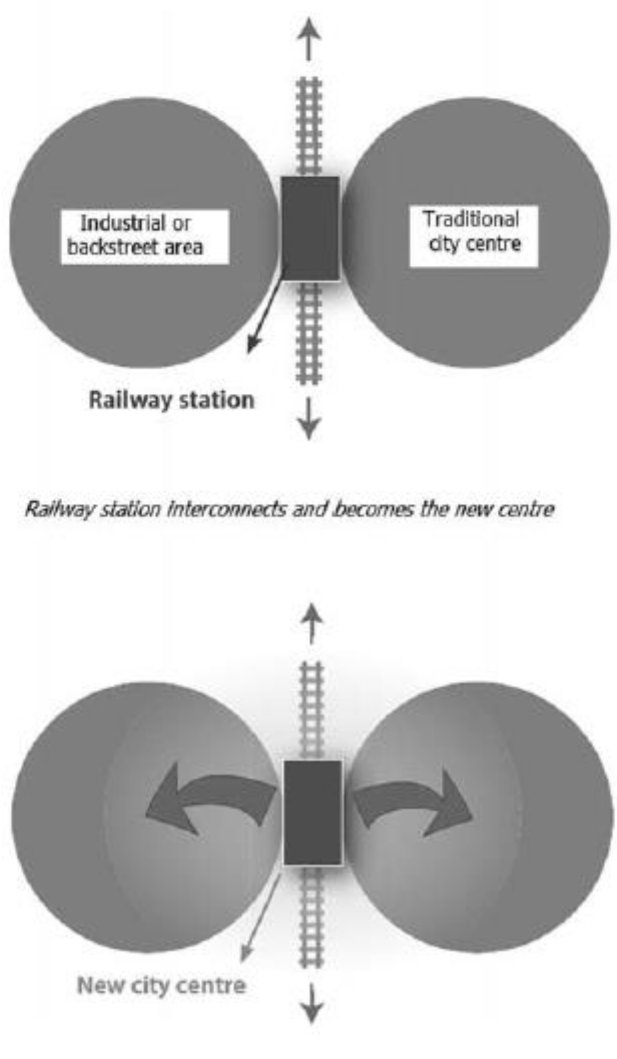

Figure 2.6: A vision of railway stations as new city centres (Peters and Novy, 2012b, p. 14)

The accepted practice of locating employment and other development near stations is accompanied by new potential for stations to link traditional centres to "industrial or backstreet" areas (Peters and Novy, 2012b) with the station acting as a connector rather than a barrier, as shown in Figure 2.6. It is worth noting, however, that this model proposes new connections through railway stations, but not across the tracks either side. The possibility of overcoming the barrier effect created by stations has been noted in various locations, for example in Zagreb where it has been argued that the city, dominated by its spatial relationship with its terminus, requires “complete functional and spatial reintegration of the railway and town” (Andrijević, Bašić and Tutek, 2005, p. 175); and the cities of Taiwan, where Li and Hsieh suggest that development behind “public transit stations” has been prevented because “the areas of the front and rear gates of a station can exhibit colossal differences, mainly due to the effects of road density” (Li and Hsieh, 2014, p. 506). Bertolini, Curtis and Renne (2012) identify tensions between the concept of a station as a controlled space serving commercial purposes, and its role as a public place with the characteristics of an outdoor urban space, providing open public access and circulation. Redevelopment has often entailed the ‘rebranding’ of station areas to communicate change to visitors. This also creates competition and potential conflict with the city centres that stations were originally built to serve.

Peters and Novy (2012b) also note that “major railway terminals are increasingly being treated as divisive intrusions into the urban fabric.” This issue came to head in Stuttgart in the late 2000s, when mass protest over the heritage and environmental impact of the Stuttgart 21 station redevelopment project contributed to electoral defeat for the regional government. This is offered as an example of “the twenty-first century revalorization of stations (areas)” (Novy and Peters, 2012, p. 143). Durrant identifies controversy in London, with the successful case for the construction of the High Speed Two link from London to Birmingham characterised by a “dominant narrative of speed” at the expense of local considerations (Durrant, 2015, p. 241). The King’s Cross Central, Regent Quarter and King’s Place developments, on former goods yard and industrial areas behind King’s Cross Station, drew criticism of their relationship to the local area, and their regeneration described as “not primarily a process serving the low- and middle-income people in whose name regeneration policy was developed” (Edwards, 2009, p. 23).

Bertolini, Curtis and Renne distinguish between the “place” and “node” roles played by stations, with the “place” element a “dense and diverse conglomeration of uses and forms accumulated through time, which may or may not share in the life of the station.” This, however, is seen as a problem and leads to many actors becoming involved in station projects, including local residents and businesses, who “are often conflicting and at best uncoordinated” (Bertolini, Curtis and Renne, 2012 p. 44). The principles of Transit-Oriented Development are reduced to a means of maximising development volumes at stations, with

Curtis, Renne and Bertolini (2009) accused of representing "TOD as a matter of attracting and designing residential and commercial rail development at stations" without connecting them to the rest of the urban network (Mees, 2014, p. 469).

Impacts of rail station development

Peters and Novy (2012b) identify a major research gap in understanding station area development projects. Despite the prevalence of rail station redevelopment, very little research has moved beyond individual case studies to compare the effects of such projects. They find no empirical research to substantiate claims that railway station areas have been experiencing a "renaissance", a shortcoming they describe as "a glaring omission". Their contention is supported by Loukaitou-Sideris, Cuff, Higgins and Linovski (2012) who, in the more specific context of economic development objectives, believe that "there is little systematic evidence as to which factors lead to positive and desirable development patterns around HSR stations" (Loukaitou-Sideris, Cuff, Higgins and Linovski, 2012 p. 52).

Peters and Novy propose a new research approach to fill this gap, with the specific objectives of promoting a different, more balanced type of station area development suitable for supporting "mixed-use" development and helping to "develop more sustainable human settlements" (Peters and Novy, 2012a p. 6). They define two linked phenomena: redevelopment of major, inner-city stations as multi-modal transport hubs; and redevelopment of "under-used land inside or immediately adjacent to the station buildings" (Peters and Novy, 2012b p. 13) and argue that research should focus on these specific areas, but make the assumption that the areas in question will, through their proximity to a station, not only be available for re-development but will also require it.

The objectives laid out by Peters and Novy (2012b) are echoed by Bertolini, Curtis and Renne (2012) who suggest that station developments have the potential to create "a degree of human interaction… that is difficult, if not impossible, to achieve in much more socially segregated car-dependent urban environments" (Bertolini, Curtis and Renne, 2012 p. 41), and that to do so "is above all a matter of increasing densities and functional mix." (Bertolini, Curtis and Renne, 2012, p. 44). Discussion of railway host neighbourhoods is limited to the category of "urban development projects" which aim to redevelop "station-adjacent property", often creating new "train station quarters" (Peters and Novy, 2012b, p. 21). The development envisaged is centred on the station and looks outwards from the perspective of its functions.

The railway terminus in its original nineteenth century form, as represented by the majority of the London terminals, is seen as having a front and a back. Peters and Novy (2012a) describe the railway station as "typically divided into two incongruent, socially segregated environments". At the front of the building are hotels and businesses aimed at travellers often forming an urban centre of their own. This newer centre may be shaped by public spaces in front of the station, creating a formal entrance to the city, and linking the station to the older city centre. This contrasts with the back of the station which would "typically exhibit a mix of less desirable uses" including factories, noise, pollution, "squalid working-class rental housing" and red light districts (Peters and Novy, 2012a). There is a "close functional relationship between prostitution and the railway station" (Ashworth, White and Winchester, 1988, p. 204). They suggest that this is not only explained by proximity passing trade, but also by the location of stations in transition zones at the edge of central business districts. The station "produced new boundaries", both culturally in terms of separations between public and private, 'good' and 'bad' but also literally, "facing the city" while behind "new zones of urban deprivation emerged" (Bieri and Gerodetti, 2007, p. 222).

A stereotype developed to characterise areas behind stations, which forms part of a strong narrative prioritising the station and its functions over its surroundings, is alive in the most recent literature. Peters and Novy's analysis identifies the frequent contrast between front and back, the areas designed to be seen by travellers as they pass through and the places not designed for travellers. However, the existence of semi-legitimate and fully illegitimate businesses behind stations demonstrates the attractiveness of such places to those passing through. Clearly less 'desirable' uses are in fact desired too by travellers and others and form part of a station's attraction along with formal, recognised uses.

A new research agenda for railway station areas

It is notable that recent discussion of rail station redevelopment does not venture beyond the immediate surroundings of the station, focusing on land owned by railway companies, that or adjoining their property and likely to experience value uplift, a sub-set of a more diverse area that is inevitably effected by any development. Development that is "adjacent" is as close as even strong critics of mega-projects, such as Peters and Novy, come to a recognition of separate surrounding areas with their own identities. The primary contexts in which the surroundings of a station are discussed in current research are a) as land owned by railway companies, which they aim to dispose of for profit b) as vacant land, no longer required by industry c) as part of the route used by those on their way to or from a station. Stations are discussed as containers for various functions, not only transport, but also retail and entertainment, and the debates about whether spatial redesign can enable station development areas to operate more or less successfully.

Yet Bertolini and Spit (1998) recognise the particular urban situation of railway stations which, unlike other types of heavy transport terminus such as air or seaports, "tend to be where they were originally built. By now, however, they are immersed in a dense, functionally-mixed and historically stratified urban fabric" (Bertolini and Spit, 1998, p. 15). Their re-categorisation of railway stations as both transport nodes and places within the city (Bertolini and Spit, 1998) goes some way towards understanding railway host neighbourhoods from a new perspective. However, their "node and place" model remains a station-focused approach. It has since been applied to rethink the role of station within an urban network (Paksukcharern, 2003), but not the nature of the places that exist alongside them, nor the unintended, incremental or unmapped influence of station development rather than its planned and intended effects. Research based on the "node and place" model sees the "place" element either as the station and its contents or from the perspective of the impact of a station development on an entire city (Trip, 2007).

As far back as 1996 Bertolini concluded that "the liveliness and long-term social and economic viability of the place the station identifies also rest on the plurality of its dimensions, on the variety of uses and people it is able to contain" and suggested that this required the "co-existence of differences" (Bertolini, 1996, p. 134). Current research assesses the various types of conflict and benefit generated by station area development from a transport perspective, whether that of shareholders, managers, planners or passengers. There is a lack of investigation into the conflict between priorities for developing networks at regional or national scale, and the local choices made about the relationship of a station and its owners and users to its immediate surroundings. Yin, Bertolini and Duan, assessing the potential impact of China's planned high speed rail network on its cities, note "an opportunity for reconstruction of the urban system, both in spatial and economic terms" but acknowledge that achieving "a balance between the node and place dimensions" is a "key issue for further research" (Yin, Bertolini and Duan, 2014, p. 48).

This view offers a narrow scope for projects intended to benefit an entire city, to create new, more sustainable places and even to form the keystone of new economic ambitions. A greater understanding of the nature of London's railway terminus host neighbourhoods would include research into their historical characteristics and development; the growth and construction of local railway infrastructure over time; the relationship between their spatial connectivity and their role in relation to the remainder of the city; the particular nature of the urban spaces created by railway development; and the benefits they deliver, intended or otherwise.

The research base on the role of the railway station within a city remains limited in scope. Approaches are concerned with improved station redevelopment, the optimum modal configuration, the cost-benefit equation, and the changing role of the station. They rarely move beyond the physical confines of the station or the conceptual assumption that the driving rationale for an urban area containing a station is the station and its functions. Redevelopment concerns railway-owned land to discuss the neighbourhoods that host stations. Existing places are discussed predominantly as blank slates waiting to be re-purposed, assumed to lack history, significant buildings or inhabitants. Areas behind and around stations hardly feature in the academic literature unless they offer substantial scope for redevelopment, or are scheduled for demolition to create space for development catalysed by the presence of the railway station.

The research gap identified by researchers such as Peters and Novy and Loukaitou-Sideris *et al.* on the impact of railway station redevelopment, needs to be filled. However, the purpose of such research can and should be wider than they suggest. Research should look outside the context created by development, and past boundaries generated solely by land ownership. There is a need to understand how areas experience unplanned consequences as well as planned effects, what those are, and how beneficial effects can be encouraged and negative impacts mitigated. The long-term impact of railway interventions should be more clearly understood to create an informed, evidence-based understanding of places not seen as relevant to a transport-oriented view of the world. The next chapter sets out the methodological approach taken to examining this impact in London.

Chapter Three: Methodology

Station selection

The origins of London’s terminals

The decision to allow the creation of the UK’s railway network through competition bequeathed London a uniquely large number of railway terminals, more than any other city, which require a proportionate mileage of railway infrastructure. The 1846 Metropolitan Railway Commission’s decision to create a railway exclusion zone set the boundaries for new terminals around what was then the edge of developed London. Although this exclusion zone was not consistently enforced terminals lined up around its edge. Even the final London terminus, Marylebone, built after London had grown much further out, was sited along the same axis. This has led to rail infrastructure becoming concentrated around the edge of what remains inner London, establishing a front/back spatial relationship with terminals orientated towards the central destinations favoured by the visitor, and facing away from areas crossed by railway lines, goods yards, maintenance facilities and other land used for railway servicing.

There is variation in the pre-existing condition of the sites chosen for London railway terminals. Some, such as Euston, King’s Cross and Paddington, were built on the closest plots of empty land to the edge of developed London, and their approaches were therefore constructed through largely open country. Terminals built later in the nineteenth century, including Marylebone, St. Pancras and Waterloo, required the demolition, to varying extents, of existing streets and houses to accommodate new station buildings and approaches.

London Bridge Station was built in a different setting. The viaduct to London Bridge was built across open fields to the edge of Bermondsey, but demolition was required for the station itself. The site was within Southwark, one of the oldest established parts of London. The street pattern dated back to medieval settlement, rather than to the Georgian or Victorian development found in nearly all the other study areas. The age of the buildings in the area led to earlier reconstruction than in newer areas, with the extensive slums of the Mint demolished during the mid-nineteenth century. Most neighbourhood reconstruction in the vicinity of other terminals took place much later, as Victorian housing decayed and fell out of fashion, with extensive slum clearance beginning in the 1930s.

Victoria Station was also built on land already part-developed, but its route used the pre-existing valley of a watercourse which had become a canal, a natural barrier across the area. Nevertheless, the separation created by the construction of its approached directly influenced the intentional social divide between Belgravia and Pimlico, expressed in the different designs of the two developments. Thomas Cubitt, having failed to prevent the railway being built, accepted that Pimlico was disadvantaged by its separated location, and could not be developed to attract the social elite who occupied Belgravia.

The relationship between the London terminals and their surrounding neighbourhoods is likely to have been influenced by their origins, as well as by the type of infrastructure built to connect them. However, the demolition required for the construction of a number of the terminals was the beginning of a continuing programme of periodic clearance. As the station expansion maps show, the majority of the stations studied have expanded from their original size during the intervening decades. Of the station buildings only the most recent, Marylebone, continues to occupy the same footprint as it did when first opened. Station expansion continues to require the demolition of established streets and buildings.

Terminals chosen for analysis

Eight London terminals have been chosen for analysis. These include the largest London terminals, but do not represent the full group of stations generally defined as London terminals. A number of stations have been excluded, both for reasons of typology and because of data limitations.

A terminus is commonly thought of as a station where the majority of services terminate rather than passing through. This basic characteristic is important to this analysis. The lack of railway lines in front of a terminus gives the physical character of the front area different characteristics to that at the back, where railway lines are located. A station served by through lines will have a different relationship with its surroundings, accessible from one or from both sides, but lacking the broad approach area found in front of a terminus. Not all terminals, however, are approached above ground. Terminals with either their approaches or entire structure located underground lack direct interface with the surface street network, other than through pedestrian tunnels, and are therefore excluded from this analysis.

The widest current definition of London terminus stations is the London Terminals Group, defined by the Association of Train Operating Companies for ticket sales purposes (National Fares Manual, 2008) contains eighteen stations. Tickets can be issued to the 'London Terminals' station group as a single destination rather than to a specific station, depending on the nature of the journey. Six stations from this group have been excluded from the analysis because they do not meet the basic characteristics of a terminus. Blackfriars (originally St. Paul's), City Thameslink (combining the former Holborn Viaduct and Ludgate Circus Stations), Old Street, Vauxhall and Waterloo East are all part of the London Terminals group, but have no terminating services and therefore no front/back orientation. In addition, Moorgate has been excluded because, although all services terminate there it is, like City, and Old Street, located entirely underground.[2]

Of the remaining London Terminals, four further stations have been excluded. Cannon Street and Charing Cross Stations are located on the north bank of the Thames, their entrances facing north, with little accessible space behind. Their location means that they do not have the same front/back orientation found at the other study terminals, because the river occupies what would otherwise be station back areas. Two other terminals, Fenchurch Street and Liverpool Street, have been excluded because they are located in the City of London. By the 1890s the City was already a predominantly commercial area, with too few residents to feature in the Booth Poverty Survey. There is therefore no social data available for the front areas of these stations, or for a proportion of their back areas, meaning comparisons with other terminals are not possible.

Table 3.1 shows the remaining terminals, chosen for analysis: Euston, King's Cross, London Bridge, Marylebone, Paddington, St. Pancras, Victoria and Waterloo Stations. Size is a common characteristic, with these stations occupying eight of the top eleven positions in the list of busiest UK stations (Office of Rail and Road, 2016).[3]

The terminals selected are served by a range of infrastructure types. Their approach lines can be broadly categorised as cutting, embankment, grade and viaduct. Each has a different engagement with the surrounding street network. Cuttings are crossed only via bridges, which are expensive to build and maintain and therefore limited in number. Grade approaches can also only be crossed via bridges (or level crossings, although these not used in inner London). Embankments and viaducts can both be crossed by routes passing beneath the railway, but while viaducts are designed with arches to allow streets to pass underneath

[2] A further three former terminals are no longer included in the London Terminals Group: Kensington Olympia, which was removed from the group in 1994 and now receives only through services; King's Cross Thameslink, also part of the group, which closed in 2007 to be replaced by new Thameslink platforms at St. Pancras; and Broad Street Station, once a busy terminus, demolished in 1986.

[3] The remaining three stations in the top eleven are Liverpool Street, Stratford and Birmingham New Street.

at any given point, embankments require bespoke bridges to be constructed over streets beneath. The spatial implications of each of these infrastructure types is analysed in detail.

Station name	Date of opening	Rail service type (excluding London Underground)	Approach structures	Concourse
Euston	1837	All services terminate	Cutting	Ground level
King's Cross	1852	All services terminate	Cutting	Ground level
London Bridge	1836	Most services terminate; some through traffic (to Blackfriars and Cannon Street)	Viaduct	Elevated / ground level
Marylebone	1899	All services terminate	At grade	Ground level
Paddington	1838	All services terminate	Cutting	Ground level
St. Pancras	1868	Most services terminate; some through traffic (Thameslink)	Embankment	Elevated / ground level
Victoria	1860	All services terminate	Cutting	Ground level
Waterloo	1848	All services terminate; through traffic via separate Waterloo East Station	Viaduct	Elevated / ground level

Table 3.1: London terminals included in analysis.

Survey timescales

This thesis takes a diachronic research approach to assessing spatial, social and economic factors in selected areas of London. The question of whether link exist between the presence of railway terminals and infrastructure, spatial effects and socio-economic patterns is addressed using both contemporary and historical data. Evidence is gathered on a timescale chosen to reflect the long-term presence of terminals and railways in London, from their introduction in 1836 until the second decade of the twenty-first century, continuing into the foreseeable future. To study the characteristics of railway terminals and their neighbourhoods, a comparison is made between two periods separated by 120 years. The application of this long-term comparative approach is novel in the context of London's railways. Data has been gathered to build, as far as possible, coherent and comparable pictures of these places in two selected time periods. A third, earlier period is also included for comparative mapping purposes only.

The earliest analysis period is the late 1820s, chosen because it predates by a very short time the opening of the first railway line and stations, including London Bridge, in 1836. The Greenwood map of 1827 has been chosen as the best quality map covering all the relevant railway terminus areas, dating from just before their construction began. It has been used to demonstrate the condition of the sites soon to be occupied by railway terminals before the railways arrived.

The second analysis period is the 1890s. The choice of this period for detailed data analysis has been informed by two factors. Overground railways were approaching their peak coverage in London by this point, and all the terminals analysed had been in operation for at least twenty years, with the exception of Marylebone, a much later addition to the network. This period therefore allows the terminals and their surrounding areas to be analysed at a time when London had grown sufficiently to surround them with urban streets, rather than the open country still found behind some terminals in the mid-nineteenth century. A further factor in the choice of this analysis period was the availability of the Booth Poverty Survey data for the period 1889-1899. The survey provides social data at an unprecedented level of detail unavailable for any other period allowing spatial analysis to be conducted alongside historical investigation at scales not otherwise possible, allied to a level of descriptive detail that adds considerably to the richness of the analysis. The use of the Booth Survey is discussed further below.

The third analysis period is from 2007 to 2014. Almost all the data used is from 2014, chosen as the preferred analysis date because it was the most recent year for which Ordnance Survey maps, address data and road centre line data were available when analysis work for the thesis began. Where possible, data were selected from 2014, meaning that basemaps, segment analysis, block size analysis and land use mapping all represent the same nominal period for each of the analysis areas.

However, for reasons explained further below, the Greater London Authority (GLA) Household Income Estimate Data used in the twenty-first century social analysis sections is based on 2007/08 data, considered more accurate than the extrapolated 2014/15 data also available from the same source. In the sections where this data is used the analysis period therefore extends back to 2007.

Front and back

The railway terminus, as seen from the perspective of ‘the wrong side of the tracks’, is designed around a spatial and functional distinction between front and back. The “incongruent, socially segregated environments” of Peters and Novy (2012a, p. 7) are associated with a separation between public-facing and service areas. “Cities within a city”, their front areas are the equivalent of formal streets, where main entrances to buildings are located, while areas behind the scenes that are inaccessible to passengers are similar to the service roads which located vehicle access and maintenance activities out of sight.

However, at a terminus station the separation between front and back goes beyond the station building itself. The front and the back of the station have entirely different spatial relationships to the surrounding city. Station frontages have entrances and exits leading directly to the closest streets. The urban street grid may reach directly to the station entrance, and passengers will step directly from the public realm into the station realm. On the other hand, the back of a station offers no such access. As the analysis chapters show, some London terminals have side entrances but there is little that could be construed as a back entrance. While a terminus with its platforms underground, or with its approaches decked over, would not have the same impact on the street network, the terminals analysed here are all approached above ground. This means that train operation areas occupy the space behind a terminus, necessarily restricting not only access to the station but also the street network and public realm behind a station. Points at which traffic or pedestrians can cross over or under the ‘station throat’, where lines cluster to enter station platforms, are limited to where bridges or tunnels are provided.

The approach of dividing railway neighbourhoods into ‘front’ and ‘back’ has been used to investigate whether spatial, economic and social characteristics differ, according to their relationship to railway terminals. This thesis hypothesises two distinct transformational processes taking places either side of London terminals over a long period of time. In front of terminals, the development of the city is not restricted by the presence of the railway, which does not physically intrude into the street pattern. In contrast, areas behind the station contain a different combination of physical fabric, including not just streets, spaces and buildings but also railway structures which restrict public access. Over time spatially based change can be observed, with areas containing the bulk of the station structure and its approaches developing in a different direction, exhibiting symptoms of physical separation and segregation. It is suggested that the influence of open station frontage and closed station approaches and non-public areas is different, and systematic comparisons between the two are needed to test whether these two parallel processes of change have occurred and to what extent. An examination of front and back areas for each terminus will also show whether the effects differ depending on the type of railway structure present, and whether they differ according to the setting in which the station was first built and continued to develop.

The concept of front and back areas, however, culturally loaded and the research therefore consciously recreates cultural stereotypes to objectively assess their validity. Goffman (1990), analysing day-to-day encounters and routines, associated the concept of 'front' with settings created for public performance, where "a performance is "socialized", moulded, and modified to fit into the understanding and expectations of the society in which it is presented" (Goffman, 1990, p. 52), in contrast with the concept of 'back', where there is no expectation of public presentation. Giddens (1986) connected Goffman's observations with ideas of the body and personal relations, 'front' carrying a double meaning as a social strategy for avoiding shame as well as a spatial description, while 'behind' or 'the behind' denotes socially unacceptable, shameful regions of the body. Giddens applied these ideas to "front/back contrasts" in cities, with "regions of frontal display" and "back regions of urban decay" (Giddens, 1986, p. 130). However, 'back' regions are also locations of social liberation, where social actors can relax and let their guard down back-stage, off duty and no longer on display.

The station "produced new boundaries", both culturally in terms of separations between public and private, 'good' and 'bad' but also literally, "facing the city" while behind "new zones of urban deprivation emerged" (Bieri and Gerodetti, 2007, p. 222). The back of the station which would "typically exhibit a mix of less desirable uses" including factories, noise, pollution, "squalid working-class rental housing" and red light districts (Peters and Novy, 2012a, p. 7). There is a "close functional relationship between prostitution and the railway station" (Ashworth, White and Winchester, 1988, p. 204). They suggest that this is not only explained by proximity passing trade, but also by the location of stations in transition zones at the edge of central business districts.

Vaughan points out how this front/back distinction became apparent to railway travellers as embankments and viaducts were built over nineteenth century city neighbourhoods. Passengers passed over “the darkness under the rail” on embankments and viaducts, as dramatically illustrated in Gustav Doré’s viaduct engraving (Figure 8.3, Chapter Eight), able to gaze directly into the back courts of the poorer neighbourhoods beneath (Vaughan, 2012). The association between railway lines and London’s ‘back stage’ neighbourhoods was identified by Charles Booth, who described “the bird’s eye view” trains gave the traveller of back yards beneath where private spaces containing not intended for display. Private aspects of houses such as clothes hanging on the line, settings for hobbies such as gardening and pigeon fancying, and relaxation “with friend, pipe and glass” were made visible to all (Booth, 1888, p. 282). Railway structures highlighted spatial and social contrasts within the city by making them apparent, but they did not break these divisions down. Travellers were granted glimpses of separate, adjacent worlds but passed through, over or under them at speed, disembarking at destinations designed only to provide convenient access to the city centre, the public stage. Olsen notes that for the Victorian middle classes the effect of the railway was entirely different to the experience of those living under the passenger gaze. The new lines allowed those who could afford it to escape the inner city for new, railway accessible outer London suburbs, where they found not only the space but also the privacy that unavailable to those who remained in the poorer, inner London neighbourhoods (Olsen, 1976). The railway was seen by contemporaries to have preserved the Victorian institutions of home and family from “urban contamination” (Olsen, 1976, p. 113), allowing them instead to expand into new territory that provided space to cultivate ways of life not on offer in the crowded city, with the facility to travel into work every day by train.

Station neighbourhood definition

The analysis seeks to test the proposition that ‘railway neighbourhoods’ can be defined, as a basis for making comparisons between the ‘front’ and ‘back’ areas of each study station, and between these areas at each station. To assess the characteristics of station neighbourhoods, common parameters have been used to define an area for analysis around each of the terminals. The same areas have been used for both analysis periods, to ensure comparability.

The purpose of the analysis is to examine the influence of railways on local areas. Railway lines pass through many parts of London, but this research is limited to the areas closest to railway terminals themselves. This decision was made on the basis that any effects were most likely to be found in the vicinity of the largest railway structures, and to limit the research to a manageable scale. Examining the neighbourhoods of every line in London would be too large a research task.

The neighbourhoods surrounding the study terminals were defined using an 800m radius circle, centred on the main front entrance, representing the distance covered in an average 10 minute walk (as the crow flies). The boundaries of the areas analysed were then chosen by extending this radius to the natural boundaries of each neighbourhood within the radius.

The 800m buffer has been chosen to represent the area covered in an average 15-20 minute walk, an area proposed by Vaughan *et al.* for analysis of the local spatial properties of Greater London suburban centres (Vaughan *et al.*, 2010). Research into the relationship between railway stations and property prices supports this choice of radius. While transport has long been recognised as an enabling technology (Knowles and Ferbrache, 2016), enhancing accessibility and usually increasing the value of land, and of commercial and residential property, stations may have positive effects on property values up to 1.5 km or more, but negative effects on their immediate surroundings (Knowles and Ferbrache, 2016).

The definition of 'front' and 'back' railway neighbourhoods for this analysis is a conscious attempt to test the 'wrong side of the tracks' stereotype by applying its assumptions to the selected London terminals and examining how well they represent reality. The hypothesis that the presence of a railway terminus and railway approaches generates area boundaries and, in turn, social and economic separation, is applied to each case study. It is tested partly by attempting to define neighbourhoods in relation to each stations, as either 'front' or 'back'. This reveals that boundaries between front and back areas can be established with differing levels of certainty, depending on the station.

Defining the natural boundaries of a railway neighbourhood has proved simpler in some locations than in others. Neighbourhoods have been defined by identifying established place names describing areas that match current local electoral ward names and boundaries. Using this method, neighbourhoods with accepted boundaries and generally uncontested identities have been identified. Almost all established place names in the study areas pre-date the arrival of the railways. Many front of station areas, for example Belgravia, Bloomsbury or Marylebone, form part of the inner, central London street grid and have their origins as distinct neighbourhoods in long-standing landed estate ownership, established before the arrival of the railways. By contrast, a number of back station areas, such as Paddington Green, Pimlico, Somers Town or Westbourne Park although already named, did not develop distinct urban entities as extensions or additions to London, after the construction of a nearby railway terminus. These areas are defined by hard infrastructural and spatial boundaries. Railway lines, in combination with main roads, rivers, canals parks and main roads, act as fixed neighbourhood edges in these back areas, in contrast to front areas.

At each of the non-viaduct terminals, the separation between front and back is marked with a clear infrastructural boundary in the form of a main road that not only serves the main station entrances and exits, but also delineates the edge of central London. The A40-A510 route that passes the fronts of Paddington, Marylebone, Euston, St. Pancras and King's Cross Stations is the northern bypass for inner London, widened and elevated in parts to carry large volumes of traffic. It marked the limit of inner London when the Metropolitan Railway Commission made its recommendations for siting new terminals in 1846 and this axis, with its cluster of stations, remains the edge of London's central business district over 150 years later. The A302, which passes the front of Victoria Station, creates a similar effect in that it marks an edge to central London. These roads create a dividing line between front and back areas.

Front and back neighbourhoods at Marylebone and Paddington Stations are further separated by the combination of the railway cutting and the Westway overpass, which share the same corridor the Grand Junction Canal. At Euston, King's Cross and St. Pancras similarly substantial cuttings and embankments mark neighbourhood edges, but the infrastructure is much more complicated behind these stations. The Regent's Canal combines with junctions and crossing points between the terminus approaches and the route of the orbital North London Line, divide the area into small areas surrounded by railway lines and canals. These divide the area into separate, fragmented neighbourhoods with poorly defined identities, lacking connections to one another.

However, elsewhere neighbourhood definitions are both more fluid, with less definitive separation between front and back areas. The terminals served by viaducts – London Bridge and Waterloo – are surrounded by neighbourhoods with boundaries and identities that are less clear-cut than those surrounding terminals served by cuttings, embankments or lines at grade. These stations are surrounded by areas with competing place names, including local authority ward names that are not used in any other context (e.g. Bishop's, Prince's in Lambeth), local neighbourhood descriptions that depend on modifiers (e.g. North Lambeth, North Southwark), or areas where names are newly coined (e.g. South Bank, More London) or re-promoted (e.g. Bankside) to reflect a repurposing from industrial to multiple uses. The absence of definitive, separating structures, with railways carried exclusively on viaducts, contributes to an absence of the 'hard' boundaries associated with other back areas, which over-ride fluid neighbourhood definitions. It is notable that the only study areas where neighbourhoods occupy both sides of the approaches to a station are at London Bridge and Waterloo, where the line are carried on viaducts.

Image 3.1: The Westway and rail approaches from Westbourne Terrace, behind Paddington.

While distinct neighbourhoods can be defined for south bank terminals served by viaducts, their boundaries are more debatable than at non-viaduct stations, and they separate less naturally into front and back areas for analysis purposes. At both London Bridge and Waterloo stations the viaducts seem to create lines of separation, but social and economic differences are not as apparent as at other study stations. Their proximity to the redeveloped areas of Thames-side industry gives the front areas of these stations different characteristics to those central London neighbourhoods north of the river. Around London Bridge, the relationship between the station and nearby main roads is also more complex, with main roads passing either side of the station, including under the approach viaduct. At Waterloo, the apparent separation between front and back is marked by the viaduct running in front of the station, rather than by a single dividing main road. However, the analysis suggests that this may not be the dividing factor that its bulk would suggest.

Victoria Station present a scenario furthest from the binary ‘front/back’ model, being surrounded by three distinct neighbourhoods. The station approaches replicate the watercourse which separated the Belgravia and Pimlico areas before houses were built there. The two neighbourhoods are located either side of the station, and both extend behind it. Rather than a single front area, Buckingham Palace and its grounds, Green Park and St. James’s Park combine to occupy the area directly in front of the station, with Westminster adjoining to the east. Victoria was built on the edge of the long-established Westminster settlement, with Belgravia developed much later to the west. The ‘front/back’ model is shown to be a simplification here, and a comparison between the three areas, each with different spatial characteristics and historical and topographical origins, has proved necessary. However, the front/back concept can still be tested by examining whether Pimlico, apparently more spatially disconnected and socially disadvantaged than Belgravia, displays ‘wrong side of the track’ characteristics.

The application of a front/back model allows the spatial impacts of large railway structures to be investigated, while also testing the concept of binary separation created by stations and railway lines. This hypothesis applies at the terminals which are located along the northern edge of central London, also approached by cuttings and embankments. At Victoria, the station is surrounded by three distinct neighbourhoods, a variation on the front/back model. The definition of front and back areas highlights the relative coherence of neighbourhoods in relation to terminals. It also challenges the assumption that all stations are the same, highlighting the different circumstances in which each station was built, and the varying development trajectories following by the places that surround them.

It can be argued that although boundaries are necessary for analysis purposes, allowing comparison between areas (Leung, 1987), the presence of precise boundaries, such as those that define neighbourhoods around the non-viaduct terminals, is unusual. Urban theorists have consistently argued that boundaries between ‘regions’ are in reality ‘fuzzy’, (Coleman, 1980; Alexander, 1988). There are few situations where a continuous boundary could be said to exist, consisting of “a space on which phenomena distribute or vary in a more or less continuous manner” (Leung, 1987, p. 125). However, railway lines are one of the few urban features which do generate a “more or less continuous” distribution of phenomena and create, through the rails themselves, a system of long, uninterrupted boundary markers with none of the fuzziness of nearly all other urban boundaries not constructed for the purpose. A railway line has similar boundary characteristics to a fence, and is usually contained within a fenced-off area of land. It thereby provides a boundary with an unusual level of precision for urban streetscapes where other markers are in reality fuzzy and interrupted, with roads for example characterised by sequences of junctions. The continuous boundaries created by railway lines define the areas of separation found in the study, where railways mark the edges of neighbourhoods, and where they divide front and back areas with differing spatial, social and economic characteristics.

A further consequence of the decision to define the analysis areas by using an 800m radius was to the creation of overlaps between terminals located close to each other. The analysis areas overlap for Euston, King's Cross and St. Pancras, and for Marylebone and Paddington. These stations, often seen as separate entities, are analysed in shared chapters to reflect their proximity and to investigate their spatial relationships. The terminals are analysed in order of construction to allow historical sequences of events to be examined more easily.

Spatial mapping and analysis

The spatial analysis in this thesis uses space syntax, an approach first developed by Bill Hillier and Julienne Hanson at University College London (Hillier and Hanson, 1984). Space syntax theory suggests that the movement of people, and consequently the location of activity, is fundamentally influenced by configuration of space. Space syntax thinking makes two basic propositions: that space is intrinsic to human activity, and that space is above all part of a wider configuration (Hillier and Vaughan, 2007). Activity in any one space is influenced by its relationship with the network of other spaces to which it is connected. Space syntax analysis measures spatial configuration by analysing the relative accessibility of each street segment from every other street segment in the network. It assigns measures of relative accessibility to each segment in numerical form. The figures generated represent the relationship between street segments, rather than any externally applicable unit of measurement. These figures are commonly represented as a heat map, and both these and numerical measurements are used in this thesis.

Space syntax analysis was conducted using DepthmapX software,[4] and symbolised using ArcGIS mapping software.[5] Angular segment analysis was chosen as the preferred space syntax approach. Segment analysis divides streets into segments at every junction, approach which allows space syntax maps to be generated on the basis of readily available road centre line data. It also provides a more accurate measure for making comparisons between long routes that cross many junctions, which are characteristic of station neighbourhoods

[4] DepthmapX © 2011-2014, Tasos Varoudis.
[5] ArcGIS 10.3 for Desktop © 1999-2014 ESRI.

(Turner, 2007). The use of angular analysis, which measures the accessibility of each segment via a route with the least change in angle, has been shown to correlate better with aggregate pedestrian movement than metric and topological distance (Penn and Turner, 2002; Hillier and Iida, 2005). All measures are weighted by segment length to normalise findings.

Contemporary segment mapping

Two new space syntax maps were created, covering 64 km^2 of the 2014 inner London street network for both the 1890s and the 2010s.

The contemporary map was based on Ordnance Survey (OS) MasterMap road centre line data, part of the OS Meridian 2 dataset[6] which includes motorways, A roads, B roads and minor roads.

Figure 3.1 shows the complete segment map, with terminals included for orientation. A natural boundary was then chosen to define the area of inner London to be mapped, creating a comparable distance between each London rail terminus and the edge of the segment map closest nearest to it. The area created has a radius of approximately 5 miles measured from Trafalgar Square, all of which is contained within Transport for London's travel zones 1, 2 and 3. The boundary of the area was defined by following major roads and rivers. Clockwise from the north, the selected boundary follows the A504 from East Finchley to Seven Sisters; the A10 and then the A107 to Hackney Wick; the A12 East Cross Route and the A102 via the Blackwall Tunnel to Greenwich; the A206 to Deptford Bridge; the A21 to Catford; the South Circular Road via Kew Bridge to the Chiswick roundabout; and the North Circular Road to its junction with the A504 at East Finchley. The resulting area reflects the natural boundaries created to the west by the River Brent, to the east by the Rivers Lea and Ravensbourne, and by the major orbital roads marking the edges of north and south London.

The downloaded road centre lines were extensively edited and corrected to ensure they matched the 1:1,000 scale Ordnance Survey MasterMap series[7] basemap, dated June 2014. Road centre lines were edited to remove inconsistencies and errors. They were redrawn where necessary to ensure they followed the centres of roads shown on the basemaps. These changes proved particularly necessary for any road containing a curve because Meridian 2 road centre lines rarely follow bends, but instead connect road end points with

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[6] Meridian™ 2 v1.2 Release 1 2014 © Crown copyright and database right 2014. Licensed subject to terms at www.ordnancesurvey.co.uk/opendata/licence

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single straight lines, providing only a crude approximation of actual road centre lines on many roads.

All car-accessible road elements missing from Meridian 2 road centre line data were manually added. These included a large number of cul-de-sacs and smaller side roads which are not covered by road centre lines, ranging from West End mews to the street systems of twentieth century estates, both types of street which were not recorded in the OS data.

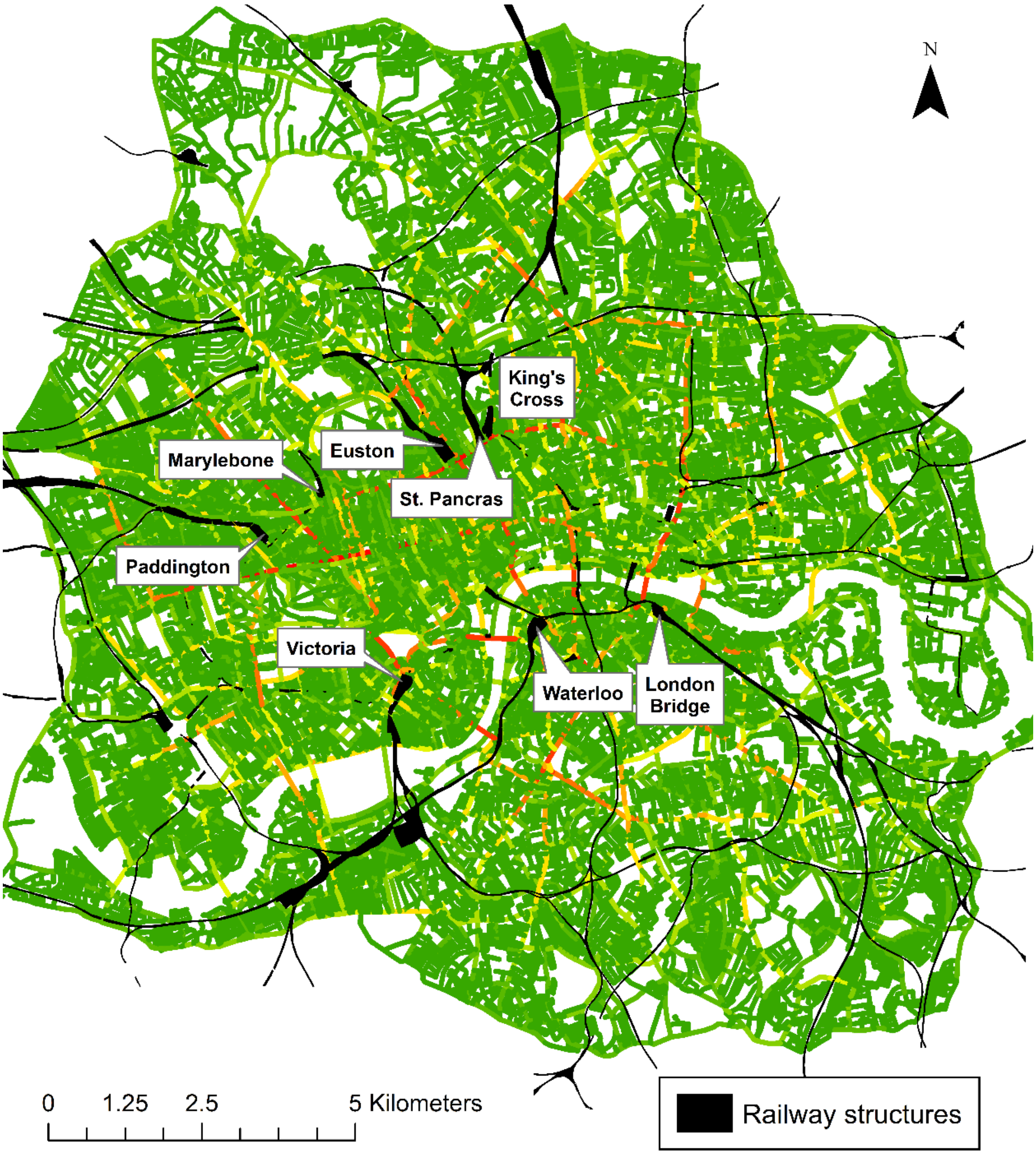

Figure 3.1: Inner London segment map with railway structures, 2014.

Dual and multiple carriageway roads, of which there are several within the surveyed area, are treated inconsistently by road centre line mapping. Their representation was edited to include a single road centre line for each direction of travel on multiple carriageway roads (but not a separate line for each lane) and to include slip roads, roundabouts, underpasses and complex junction. Multiple missing links were inserted to ensure all lines were correctly connected.

The map was then edited further to include the pedestrian movement network as well as vehicular routes in the analysis areas. Pedestrian-only routes were added, for example, riverside paths, footpaths across parks and commons, and street connections open to pedestrians but closed to cars. These also included a large number of streets of indeterminate status, often not shown clearly as pedestrian routes on OS maps but nevertheless accessible. These included many of the routes across twentieth century housing estates, which were frequently found to be essentially unmapped, with no accurate information available on the accessibility of routes. This ambiguity reflects a situation intentionally created in some places with, for example, the Ampthill Estate behind Euston Station, apparently gated to prevent public access but, in reality, almost always accessible because the gates are rarely locked. The estate therefore contains through routes only used by those in the know. In other locations, such as the Maiden Lane Estate behind St. Pancras Station, the layout is too complex and multi-layered to suit standard map representation.

These routes were added manually, using a process of checking using Google Street View data and site visits where necessary. The use of road centre line data requires a decision to be made on how to represent open spaces in segment form. For all maps in this thesis, the pre-defined pedestrian paths were traced for each open space. While not representing all possible routes, they form the best available surrogate for likely movement.

Mapping of pedestrian-only routes was undertaken to represent the reality of the movement networks in the study areas as accurately as possible. The pedestrian-only elements of the network are also important for the analysis because the nature of connections in urban fringe areas include elements of informality not necessarily found in a central street network. Furthermore, connections across railway lines in particular often include pedestrian-only tunnels and bridges as well as conventional streets. The resulting pedestrian scale maps of station areas represent new research, and the application of spatial analysis at this scale is a novel approach to the understanding of city networks.

Historic segment mapping

This map was then edited within the same boundaries to represent the road network present in the 1880s, as shown on the 1st Edition Ordnance Survey County Series 1:2,500 map of London (1871-80).[8] All street segments not in existence on the 1880s basemaps were removed, and all streets from the period that have now vanished were replaced. The map represented all streets on the map, making assumptions that there were accessible unless there were specific indications, such as gates, to suggest that they were not. This has resulted by default in a pedestrian scale map of the city, as no criteria can be identified from the basemaps to distinguish vehicle from pedestrian streets. The mapping of all routes therefore includes multiple alleyways that are too narrow for anything other than a person on foot.

The creation of a pedestrian scale segment map for 1880s inner London is new research, generating a resource that allows city-wide historical spatial analysis for this period for the first time.

It also allows network change maps to be created, overlaying the street networks for the 1880s and the 2010s in each of the study areas. These maps show areas where substantial change took place in the network during the twentieth century. They do have some limitations. Because layers are displayed with the 2010s streets uppermost, additions to the network are highlighted, but streets that have disappeared since the 1880s are concealed. Reversing the layers has the opposite effect. This maps should therefore be understood in the context of the statistics that accompany them, which represent the complete picture of network change over time.

Urban morphological analysis

Morphological analysis has also been carried out for both time periods, to provide a further means of investigating the relationship between railway terminals and their surroundings. Block size maps were produced for each analysis areas for the 1880s and the 2010s, to record continuity of massing and relative scale rather than, for example, land ownership or building demarcation. These maps allow the insights into urban hierarchies available from morphological analysis to be applied alongside spatial analysis.

Building footprints for the 2010s were extracted from Ordnance Survey (OS) MasterMap Topography data, downloaded from the OS Meridian 2 dataset.[9] These were extensively edited to represent not only conventional urban blocks, but also railway infrastructure.

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[9] Meridian™ 2 v1.2 Release 1 2014 © Crown copyright and database right 2014. Licensed subject to terms at www.ordnancesurvey.co.uk/opendata/licence

Railway approaches such as viaducts, cuttings, embankments and lines at grade are represented as city blocks, separated from each other only where they are crossed by a publicly accessible route. This new research approach shows the sometimes hidden presence of railway structures in London, which occupy areas of land which act as blocks but may not be viewed as such. It allows their size to be compared on the same basis as all other blocks, and their role as part of the urban grain to be analysed.

The completed 2010s block map was then overlaid on the Ordnance Survey 1:2,500 map of London (1871-80). The blocks were edited back to versions shown on the 1880s map, with additions removed and 1880s buildings reinstated. Blocks that had been demolished since the 1880s were traced by hand from the basemap, and added to the block map. The same principles of separation were applied, with each block bounded by the nearest accessible route.

Block maps for both eras have been symbolised using a colour scale that represents their size in square metres, to allow visual comparison. These block maps are a novel methodology, representation all the elements of the city which fulfil the spatial function of an urban block, and including infrastructure that is often represented as unrelated from the surrounding streets. The mapping approach developed for this analysis illustrates the extent to which railway terminals and the many structures related to them act as physical barriers to movement.

Land use analysis

Land use mapping – 2010s

Non-residential land uses were mapped for each of the study areas for both the 1880s-90s and the 2010s, to enable the study of patterns of activity in relation to spatial characteristics and railway structures.

OS MasterMap AddressBase Premium point data,[10] which includes a record of the land use for each address, was downloaded and edited to remove all records not related to active uses. It was then added to OS MasterMap Topography data.[11]

The data included a large number of records with land use recorded as “Property”, “Property Shell” or “Unclassified”. The editing process involved a manual check of these records,

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employing supplementary information from Google Streetview, OpenStreetMap and on the ground knowledge. This process was used to ensure that any land use other than "Residential" was identified, and the data amended accordingly. A manual check also indicated that records lacking a land use classification referred almost entirely to addresses with active uses, not to empty or derelict properties, so these uses were added. The large majority of these "Unclassified" records were found to belong to residential properties, or properties with no indication that were other than residential. The remaining "Unclassified" points were then removed on the assumption that, unless otherwise indicated, they referred to residential properties.

The AddressBase data also suffered from a number of missing entries, with a relatively large number of buildings lacking any address record. After a manual check of a sample of these, it appeared that these were building contained uses that were missing from the database. These missing records were manually added and classified to complete the Ordnance Survey data.

The AddressBase categories were then amended to fit within a bespoke land use taxonomy designed to allow comparison with 1880s land use data, as described below. A spatial join was applied in ArcGis to merge AddressBase point data with Topography building information, and all buildings categorised using this taxonomy. In other words, the geographical information system was used to attribute the land use of individual buildings to the streets on which they sit.

Land use mapping – 1880s

Information from the London 1880 Post Office Directory was used to create a map of 1880s land uses. Building footprints for the station neighbourhood were digitised from 1880s Ordnance Survey County Series 1:2,500 maps. Uses were then attributed to individual buildings using street numbering on the County Series maps as guidance, aided by the instances in which specific land uses are recorded on the OS maps (e.g. public houses). The 1880s segment map was overlaid on the resulting land use map, and each building spatially joined to the values of the closest street segment (or segments), allowing spatial values to be analysed for individual land uses.

To map land use in the 1880s for the survey areas, basemap data were used from the 1st Edition Ordnance Survey County Series 1:2,500 map of London (1871-80).[12] The building

[12] © Crown Copyright and Landmark Information Group Limited 2014. All rights reserved. 1853-1904.

outlines shown on the historic raster layer were digitised by hand, by editing the OS MasterMap Topography data from 2014. This was revised back to represent the building forms found in the 1880s. Building envelopes surviving in 2014 were retained and all other data were deleted, replaced with hand-drawn representations of 1880s building envelopes.

Land uses were then identified using a combination of data sources. Each street in the mapped area was located in the London Street Directory and Courts Directory, from the 1880 Post Office Directory for London (Post Office, 2004), and land uses transferred to the relevant building. As the directory listed entries by street number, each had to be matched with the correct building on the basemap. This was achieved by matching street numbering systems with a range of OS town plans recording numbering from the early twentieth century, as street numbers are not recorded on the 1st Edition OS County Series. Where numbers had remained unchanged, matching was straightforward. Where numbering had altered after the 1890s, land uses were matched to buildings by counting back from the cross streets identified in the Post Office Directory, and with reference to those buildings with uses already labelled on the OS map – generally larger buildings such as hotels, schools, factories, as well as pubs. Goad Fire Insurance maps were also consulted (Goad, 1886-7) where they were available for relevant areas, to allocate land uses to the correct building.

Land uses were then categorised using a taxonomy developed for the purposes of the research, compatible with the categories used in the National Land Use Database (2004), informed by the adapted classifications used by Vaughan, Dhanani and Griffiths (2013) for analysing historical and contemporary land uses in London suburban centres.

The same land use categories were allocated to both maps, to allow comparison between the two time periods. This required land uses to be recorded to prioritise comparability, addressing changes in land use types between late Victorian and early twenty-first century London. One such change has been the shift in the nature of the office since the 1880s. In the areas of London surveyed, professionals (such as solicitors, surveyors and accountants) operated almost exclusively as individuals, and were based in residential-sized premises. By the twenty-first century these have been almost entirely replaced by companies operating from much larger offices, providing modern equivalents of these services. Both functions have been categorised as 'Offices'.

In the 1880s, pre-National Health Service, the medical professions operated predominantly as individuals from private addresses, but this is now the exception. The pattern of distribution for health uses has therefore altered completely between the two periods due to this structural change, and health is therefore excluded from the comparison below.

The 1880s also saw services outside the professions provided from residential-sized premises, including trades such as building and decorating and a large number of specialised manufacturing occupations that no longer exist in the same form (e.g. blind makers, wire workers, china menders, tripe dressers etc.). The Post Office Directory features many listings for addresses that simply record a profession, without any further indication of the nature of the premises. These have been classified either as Retail (e.g. tailors, oilmen, cabinet makers) or Services (e.g. builders, carpenters, painters), depending on whether their activities result in the production of consumer goods or the supply of labour away from the business premises.

Public houses have been placed in a separate category, ‘Eating’, from cafés and restaurants because they appear to be spread much more widely across residential neighbourhoods, while eating places are rarely found beyond main streets. There is also more continuity between eras, with many pubs existing on both maps, which is not the case with eating places.

There are also wider questions of how land uses should be interpreted if their definitions have remained the same between the two periods, but their economic and social role has altered. There is a significant difference in the connotations of eating places between the two time periods. In the 1880s people either ate out because they were very well off, or because they had no cooking facilities at home, while the middle classes did not. Eating out had become more widespread by the 2010s, with fewer class restrictions, but the likelihood of eating out is now more likely to be influenced solely by income level.

Social analysis

Social analysis, 1880s-1890s

The Booth Survey notebooks (Booth, 1902) provide street-by-street assessment of wealth and poverty in the neighbourhoods around both stations. The survey maps shown here date from the second of Charles Booth’s two surveys, published in 1898.

A decision was made to analyse the maps produced for the second Booth Poverty Survey, dated 1898-9. This information was used, rather than data from the first Booth Survey collected in 1889, because the second Survey is accompanied by detailed commentary in the form of the Booth Notebooks. These field notes describe the research trips made on foot by

Booth and his researchers. They provide information the source and nature of the information collected for the maps, and insight on how categories were assigned to each street, or street segment. This information is necessary to contextualise the map data, and allow much more detailed commentary and comparison between eras.

The Booth maps and notebooks provide an unprecedented level of information about the London economy, both at a quantitative and a qualitative level. Their validity as a source of objective social data has been criticised. Booth's research was undoubtedly conducted in the context of a political agenda particular to his time. Stedman Jones discusses his opinions on the distinction between "the true working class and the casual residuum" (Stedman Jones, 1971, p. 288). Booth considered the latter to be subject to cyclical unemployment that in the long-term might actually benefit them, whereas the real unemployed were those unfit for work with no way of keeping themselves. This distinction makes little sense from a twenty-first century perspective.

Booth described his survey methods as recording "apparent status as to means'' (Booth, 1889, p. 24), and the extent to which his categories translate into a modern context is debatable, reflecting as they do inherent assumptions about the way people lived as well as income level. However, as long as the nature of Booth's inquiry is understood, the information collected by his survey is immensely valuable in revealing the everyday life of late nineteenth century London. As Hennock explains, "what Booth was counting was impressions, carefully cross-checked with other impressions insofar as those were available" (Hennock, 1991, p. 190). The cross-checking was made through individuals in positions of authority which also gave them particular knowledge, including School Board Visitors, social workers, policemen and philanthropists (Englander and O'Day, 1998), and was supported by data from other sources. Vaughan suggests that "Bearing in mind that Booth gathered copious evidence on income and patterns of employment and unemployment, it can be argued that Booth's classifications were as precise and as scientific as could be achieved at the time" (Vaughan, 2007, p. 236).

The 1880s segment map of Inner London (Figure 3.1) was re-edited for each study area to match the street patterns show on the 1898-99 Booth maps. As the intervening period was approximately ten years, the changes required were limited to individual street alterations with occasional major developments altering signification sections of the Inner London street plan, for example the demolition of Millbank Prison and its replacement with the Millbank Estate, in construction during the period of Booth's second survey.

Booth classifications were then digitised. Lines were drawn by hand to represent street frontage of every block. These lines were then assigned to the categories given to them by Booth. Where upper and lower storeys had been allocated different categories by Booth, two separate lines were traced alongside each other to represent both. This map was spatially joined to the 1880s segment map of Inner London, with minor edits to match the street network recorded in on the 1898-99 Booth maps. This linked each section frontage representing Booth categories to the spatial values of the segment or segments closest to the frontage of each building, allowing the two types of data to be analysed together.

The survey maps shown here date from the second of Charles Booth's two surveys, published in 1898. However, Booth had previously surveyed and mapped a slightly smaller area of Inner London for his first survey, which was published in 1889. The notes taken by his researchers for the second survey often refer to changes during the intervening period. Both versions of the map have therefore been consulted for this analysis.

Social analysis – 2010s

Contemporary social data is not available at the house-by-house scale recorded by the Booth Survey. For twenty-first century social mapping, the nearest equivalent modern data to the Booth Survey has been used: the Greater London Authority's Household Income Estimates (Greater London Authority Intelligence Unit, 2015). These estimates model household income for Greater London from 2001-2012. They combine a weighted range of data sources, including the Understanding Society Survey, National Statistics Socio-Economic Classification data from the England and Wales Census, house price data, the ONS Annual Survey of Hours and Earnings, the HMRC Survey of Personal Incomes and HMRC Child Poverty data. It creates a baseline for the year 2007/08, the most recent year for which ONS Model-Based Income Estimates are available, and interpolates a straight line trend backwards to 2001/02 and forwards to 2012/13. Data for 2007/08 has therefore been used for this analysis, as these are the most recent figures that are not based on trend interpolation.

The scale of information the GLA data provides is different to the Booth Survey and, while statistically verifiable and without the subjectivity of the Booth surveyors, the information it provides is at a much coarser grain. There are also limitations to the data. The GLA Household Income Estimates provide the most robust income data currently available, but neither it nor any other contemporary dataset can be obtained at the street scale used by Booth. The smallest units at which census data is made available is Lower Layer Super Output Area (LSOA) level, consisting of smaller Output Areas amalgamated where they share similar social characteristics. An LSOA contained a mean population of 1722 people in London in 2010 (Greater London Authority, 2014).[13]

The use of aggregated data, even for small areas such as these, creates research limitations. LSOA data provides a picture that is less nuanced, smooths out extremes and is dependent on the reasoning that grouped these particular places together. The so-called 'ecological fallacy' occurs when characteristics are ascribed "to members of a group when only the overall group characteristics are known" (De Smith, Goodchild and Longley, 2007). The Modifiable Areal Unit Problem is a related but separate methodological difficulty, referring to the fact that the values for each aggregated area will change if its boundaries are altered, and are therefore dependent for their meaning on the rationale used to create them. Östh, Malmberg and Andersson (2014) identify problems with accepted measures of segregation caused by the use of pre-defined statistical areas, which cause information to be aggregated so that it no longer measures the effect of segregation on individuals' experiences.

Orford, encountering precisely the same limitations when making comparisons between Booth data and contemporary social data, described the use of modern ward-level data as "a necessary limitation" (Orford, 2004, p. 716).

In the case of this analysis, the social similarities used to create Lower Super Output Areas are directly relevant to the purpose of the investigation and, together with their acceptance as a standard census enumeration geography, justify their use. The analysis aims to draw conclusions about the characteristics of areas rather than individuals, so the ecological fallacy trap is avoided. However, it is important to note that this scale and the group nature of the data does not permit direct statistical comparison with the Booth survey, and the two datasets have therefore been analysed separately. It does, however, allow wider spatial patterns to be identified and compared between eras and general conclusions drawn about spatial distribution, continuity and change of relative income.

The Household Income data has been symbolised in six categories, defined using Jenks breaks. This representation has been chosen to provide an equivalent, in some respects, to the categories used by Charles Booth in his survey without attempting to directly mirror his maps. The six categories use a different colour scheme to Booth's, to make it clearer that the purpose of this element of the research is not to create a twenty-first century Booth map, but to provide a robust, separate methodology for assessing relative contemporary wealth

13 http://data.london.gov.uk/dataset/lsoa-atlas

and poverty levels. While broadly comparable in terms of data, the two methods are not intended to allow detailed, statistical comparison between the 1890s and the 2010s.

Analysis structure

The following chapters apply these analytical methodologies to the eight London terminals selected for study. These are divided into five groups as described above, and ordered by construction date beginning with London Bridge Station, the city's first railway terminus. Each analysis chapter contains six sections: firstly, an introduction, describing the station and mapping the railway structures in their current setting; secondly, a historical analysis, describing the origins of the station and mapping its setting before construction, its evolution since the 1880s and its resulting orientation within its immediate surroundings; thirdly, a morphological analysis defining front and back station areas and analysing block size in these neighbourhoods in the two time periods; fourthly, a spatial analysis measuring movement networks at selected scales for station neighbourhoods in both time periods; fifthly, land use analysis mapping and measuring land uses types and density in the station neighbourhoods during both time periods; and sixthly, social analysis mapping Booth classifications and GLA Income estimates for the station neighbourhoods during both time periods.

This analytical approach addresses each of the research questions in turn. The long-term impact of railway stations on their neighbourhoods is assessed through diachronic comparisons between land use patterns, revealing economic change, and social patterns revealing change in relative poverty and wealth. These patterns are related to spatial networks in both periods, to test the extent to which the presence of railway structures can be related to spatial separation. Spatial analysis provides a means to assess how far neighbourhoods can be defined by the presence of a railway terminus as front or back areas; whether spatial separation can be identified and related to terminals; and whether different social and economic differences are apparent between front and back neighbourhoods, where these definitions apply. This approach allows the question of whether London terminals 'blight' their neighbourhoods to be answered a through specific understanding of the circumstances, setting and development applicable to each individual terminus.

Although the intention of the analysis is to provide detailed, evidenced understanding of the current relationship between terminals and their neighbourhoods, historical analysis is required to achieve this. All terminals in this thesis have developed over more than a century, and temporal analysis over this period is necessary to establish the spatial, social and ecological context for each one and to assess the change that has occurred in their surroundings in the time since then. Long-established pieces of urban fabric such as railway terminals exist in the contemporary city, but occupy a space within a street network and an urban morphology directly determined by their origins and historical development. An understanding of today's London terminals requires an investigation of the how they came to be the way there are.

Chapter Four: London Bridge Station

Introduction

London Bridge Station is located on the south bank of the Thames, 100m from the river. Figure 4.1 shows its location within the surrounding railway network. The viaduct system around London Bridge Station raises the railways lines above a busy road system. The station is located at the foot of London Bridge, which was for centuries the only Thames road crossing. The route via Borough High Street and London Bridge is therefore long-established as a significant entrance point to the City of London. London Bridge Station is now close to an extensive network of river crossings and through-routes, with four road bridges, two rail bridges and one pedestrian bridge all located within 1km. The station also marks the edge of central London, with the office district around City Hall ending at Tower Bridge where residential and industrial Bermondsey begins.

History

Services from London Bridge Station serve suburban South East London and the Kent and Sussex coasts. The oldest terminus in the capital,[14] it opened in 1836 when, as the only central station, it was simply known as 'London'. The four-mile route to Greenwich was a novelty when it first opened, with orchestras and entertainment provided at stations (Rasmussen, 1982). However, it was also the first railway designed to be used by commuters, and carried half a million passengers in its first year (Rasmussen, 1982).

Figure 4.2 shows the area around the station, shortly before it was built. London Bridge Station occupied the eastern part of the St. Thomas's Hospital site, shown below. Beyond Southwark and The Borough, south London was sparsely built up in the early nineteenth century, and much of it remained undrained, marshy ground. Houses and wharves hugged the river, but the land quickly became more open to the south. This meant that only the final kilometre of the viaduct to London Bridge Station had to be constructed through an already built-up area. However, the station site was in the heart of Southwark, the longest-established settlement south of the river. Here, from the foot of London Bridge to The

[14] The first London terminus was Spa Road Station in Bermondsey, which opened nine months earlier. However, it was used as a temporary measure while the viaduct through to London Bridge, which took longer to complete than anticipated, was finished.

Borough, development was dense with labyrinthine courtyards lining Borough High Street, including slums areas such as The Mint. The construction of the station involved the clearance of around three hectares of buildings, including two streets named on the Greenwood map but many more unnamed courts and alleys. Like much of the built up area of The Borough and Southwark, these are recorded on contemporary maps, including the Greenwood map above, as unlabelled spaces between buildings without formal status as streets.

London Bridge Station was built by the London and Greenwich Railway Company but, even before it opened, the Government had decided that it was to be shared with other operators. From 1839 the London and Croydon Company began to use the viaduct between Bermondsey and London Bridge, and built Corbett's Junction near the modern South Bermondsey Station which, as one of the earliest railway junctions, was initially controlled by a traffic policeman. Two further companies soon became involved – the London and Brighton Railway in 1841 and the South Eastern Railway in 1842 – and the viaduct was doubled in width to accommodate their trains, requiring the demolition of houses on the north side along much of its route. Figure 4.3 shows the expansion of the station and railway structures since it first opened.

Two new station buildings were planned, one for the London and Greenwich Railway and the other for the Croydon, Brighton and South Eastern companies. However, a sequence of corporate upheavals during the 1840s meant that the latter was never completed. The Croydon and Brighton companies withdrew from London Bridge in protest at toll charges, and built their own short-lived, inconveniently located terminus 1.25km to the south at the Bricklayer's Arms. Shortly afterwards three of the companies merged to form the London, Brighton and South Coast Railway, moving back to London Bridge and demolishing their half-completed station in favour of a larger replacement. This left only the South Eastern using the separate, adjacent building, and London Bridge Station consisting of two separate terminals, adjacent but poorly connected.

Originally a true terminus, with all services terminating, the pressure of rapidly increasing passenger numbers in the 1850s led to the introduction of through services to manage demand. The railway was connected west from London Bridge, requiring the demolition of the original London and Greenwich Station and of buildings between the station and Borough High Street.

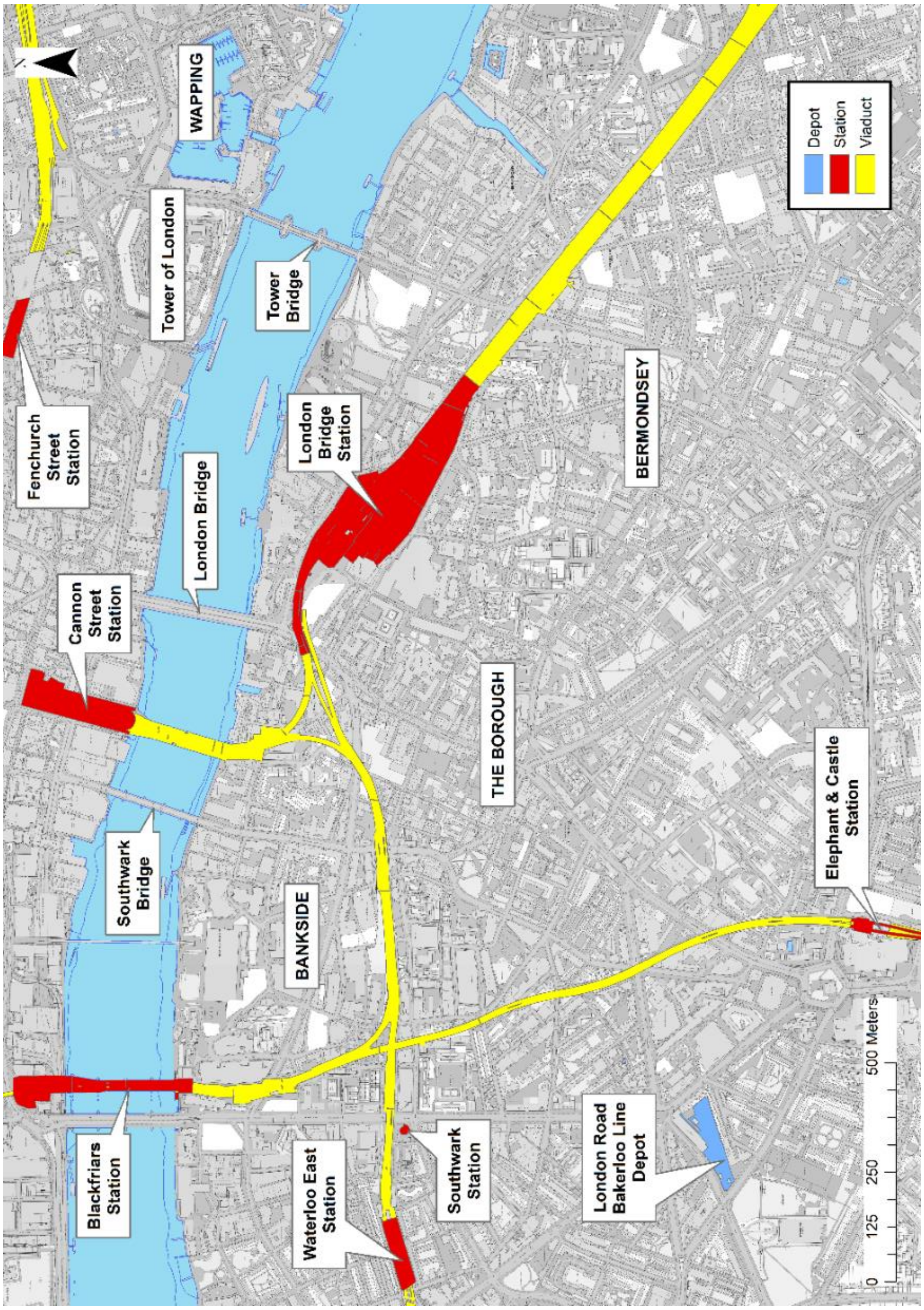

Figure 4.1: London Bridge station and infrastructure.[15]

[15] Except where stated, all underlying maps © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service.

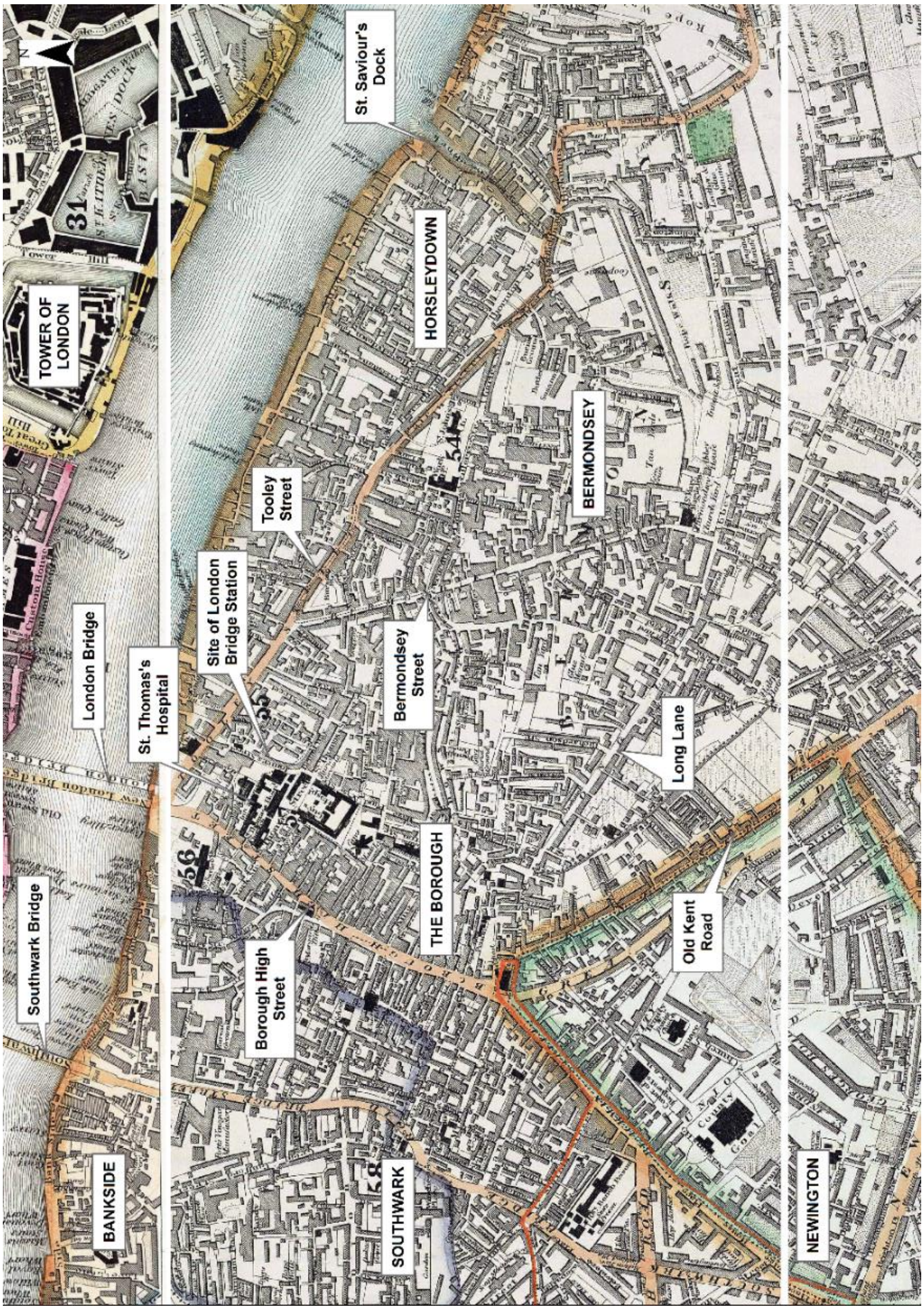

Figure 4.2: London Bridge area, Greenwood Map 1827.[16]

[16] Greenwood Map throughout is copyright © Motco Enterprises Limited, www.motco.com. Blank lines across the map show where information is missing at the edges of adjacent sheets.

The construction of new viaducts, which eventually connected London Bridge to Cannon Street, Blackfriars, Waterloo East and Charing Cross, was possible largely because the land in question was owned by the Church of England. Between them, the Archbishop of Canterbury and the Bishops of London, Rochester and Winchester owned the entire South Bank between London Bridge and Nine Elms, and the Church was prepared to accept demolition on its land to allow the railways to be built (Kellett, 1969). The new viaduct had to tackle various obstacles: buildings in front of London Bridge station were cleared; a new bridge built over Borough High Street; a sharp swerve incorporated to the south to avoid Southwark Cathedral; and substantial compensation paid to St. Thomas's Hospital in exchange for a corner of its site. However, much of the route was "relatively undeveloped", with a jumble of "riverside trades, timberyards and rope-walks, warehouses and cheap cottages" (Kellett, 1969, p. 256), which were cleared. Bermondsey in particular was seen as an area of abject poverty. The project superintendent described the difficulties of building the new line through "the most horrible and disgusting part of the metropolis" (Walter, G., 1841, quoted in Thomas, 1972, p. 30).

Extensive demolition was again required in 1901, when the viaduct was expanded to the north from London Bridge to Spa Road, Bermondsey. This required the clearance of houses along a 1.5km route and the displacement of residents.

From confused origins, London Bridge Station grew into a muddled building (Jackson, 1969), both architecturally and functionally. The main approach to the station was, and still is, either under a low, obliquely angled railway bridge, or through an arch in a brick wall on Tooley Street, neither offering a view of the station itself. Despite this, no major structural changes took place between 1902 and 2011, when the viaduct over Borough High Street was widened. The Terminus Hotel, built in 1861, was intended to unify the station and provide a single frontage, but it was not a commercial success and was destroyed by Second World War bombing. The Shard tower now occupies the site.

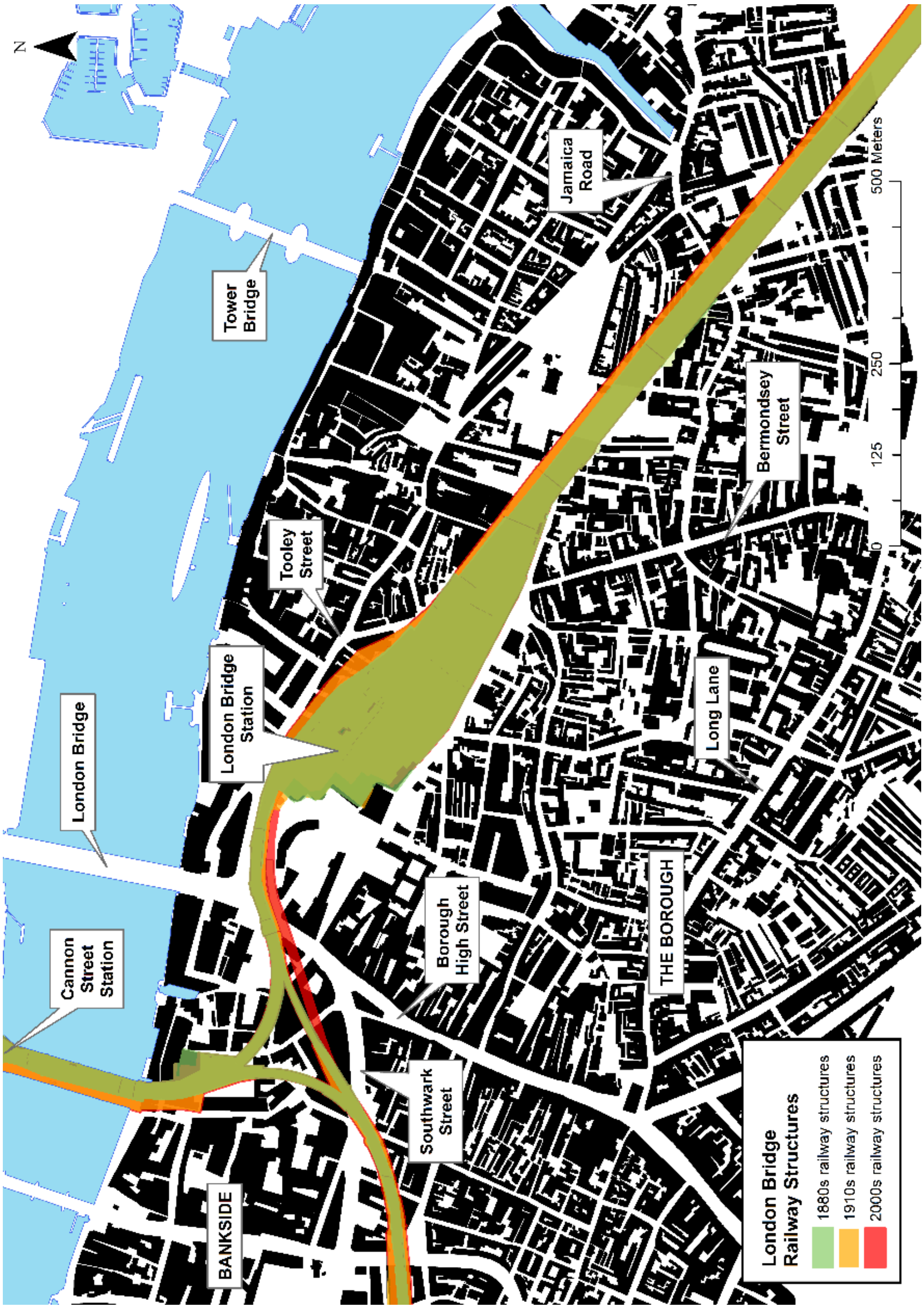

Figure 4.3: London Bridge Station expansion, 1880s-2010s.[17]

[17] This and all subsequent historical maps are © Crown Copyright and Landmark Information Group Limited 2014. All rights reserved. 1853-1904.

Image 4.1: Tooley Street entrance to London Bridge Station.[18]

The station was partly reconfigured in the early 1970s with a new, dark brown canopy and a new entrance via a first-floor level bridge across Tooley Street (see above). These temporary solutions replaced a cancelled rebuilding scheme which was much more ambitious, and would have used an office tower to fund an entirely new station. By this point London Bridge was being described as “the most hideous of all the terminals” which “cries out for rationalisation and rebuilding” (Jackson, 1979 p. 167). Total rebuilding was eventually deemed the only solution, and a five-year reconstruction project was, at the time of writing, scheduled for completion in 2018.

[18] This and all images by the author, unless otherwise stated. Images were taken in Spring 2017, unless otherwise indicated.

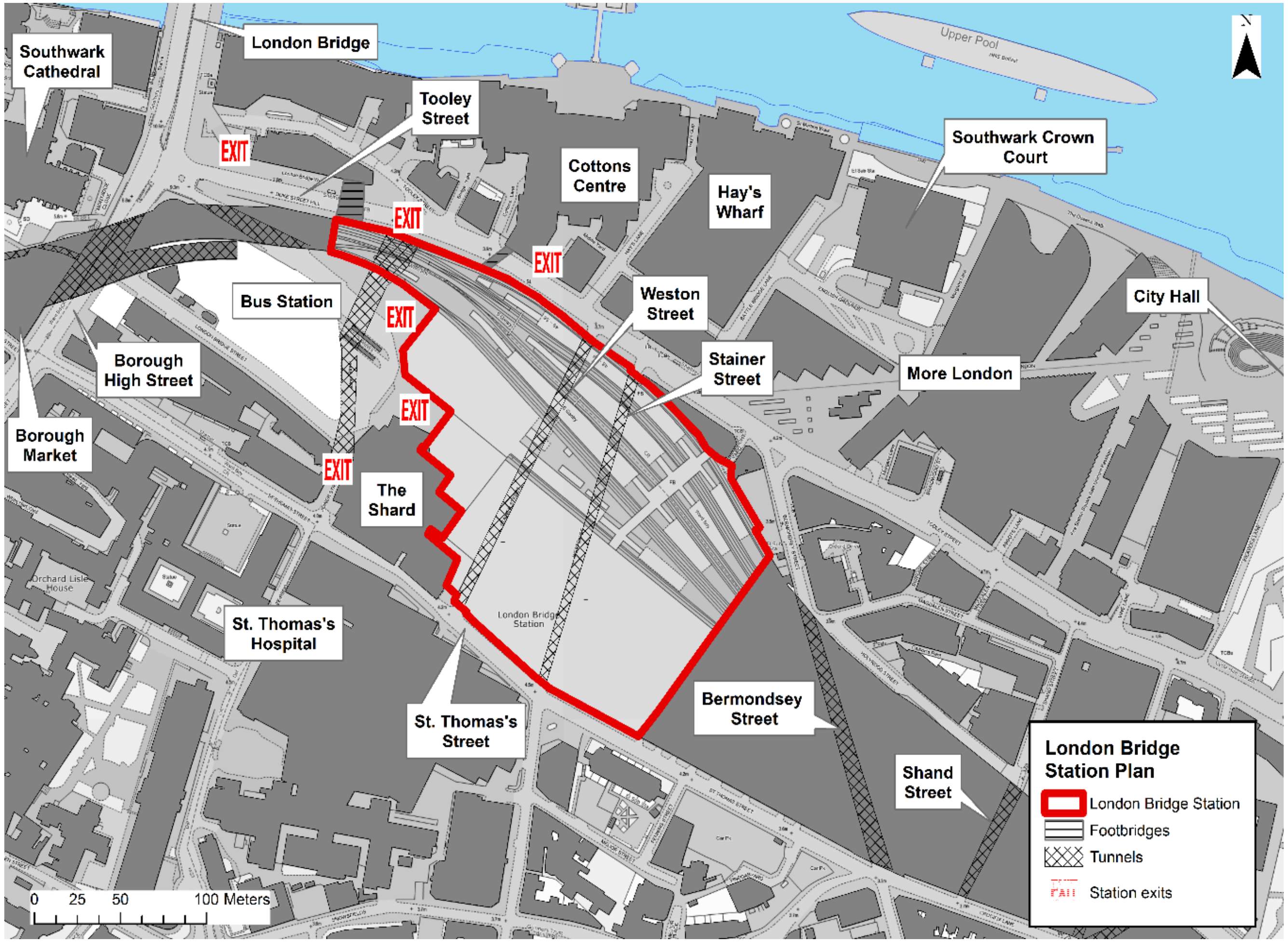

Figure 4.4: London Bridge station plan, 2014.

The station frontage is set back some distance from Borough High Street, behind the railway bridge and several buildings, including a large office block which was under construction at the time of mapping (completed in 2015). The main station exits lead to the area immediately in front of the station, occupied by bus stops. They also lead on to Tooley Street, which runs along the north side of the station. This provides the most direct access to the commercial blocks beside the river and to London Bridge, the archetypal City commuter route into work. Two footbridges connect pedestrians across Tooley Street to the Cottons Centre and the foot of London Bridge. Only one route leads south of the station, a dual level tunnel and escalator exit to St. Thomas's Street and St. Thomas's Hospital. The station frontage is to the north and to the north-west, and passengers exiting the station are therefore drawn on to Tooley Street and towards London Bridge.

Areas behind the station can only be reached by walking along the viaduct and crossing beneath the tracks via Bermondsey Street which is a long, forbidding tunnel (see Image 4.2). The station and its viaducts were built over the pre-existing street network, so several ground-level routes pass underneath the full width of the station or its approaches in similar tunnels.

Image 4.2: Former Stainer Street, now part of London Bridge Station.

The station redevelopment, still underway at the time of writing, has incorporated two of the streets that pass under the station approach viaduct – Stainer and Weston Streets – into the station to create new circulation routes and exits. Before work began both were public highways, but are now permanently closed to traffic and to non-passengers. The relationship between the station and the surrounding street network will therefore change. While there are now more exits to the north and to south, access to areas behind the station to the east will still only be possible by tracking back alongside the viaduct.

London Bridge neighbourhoods

Front and back neighbourhoods have been defined for analysis as shown in Figure 4.5. In front of the station are the neighbourhoods of Bankside and Southwark.[19] These are separated from each other by the railway viaduct to Waterloo East, and are bounded by Borough High Street to the east and Blackfriars Road to the west. The area between the station and the River Thames is usually known as London Bridge, and is directly served by exits on the north side of the station.

Behind the station Tower Bridge Road forms the western boundary of Bermondsey. Closer to Borough High Street, the streets of The Borough are bounded to the south by Trinity Street, Great Dover Street (the A2) and the Bricklayer's Arms Roundabout.

[19] This is the neighbourhood of Southwark, not to be confused with the much larger London Borough of Southwark, created in 1965 by amalgamating the Metropolitan Boroughs of Bermondsey, Camberwell and Southwark.

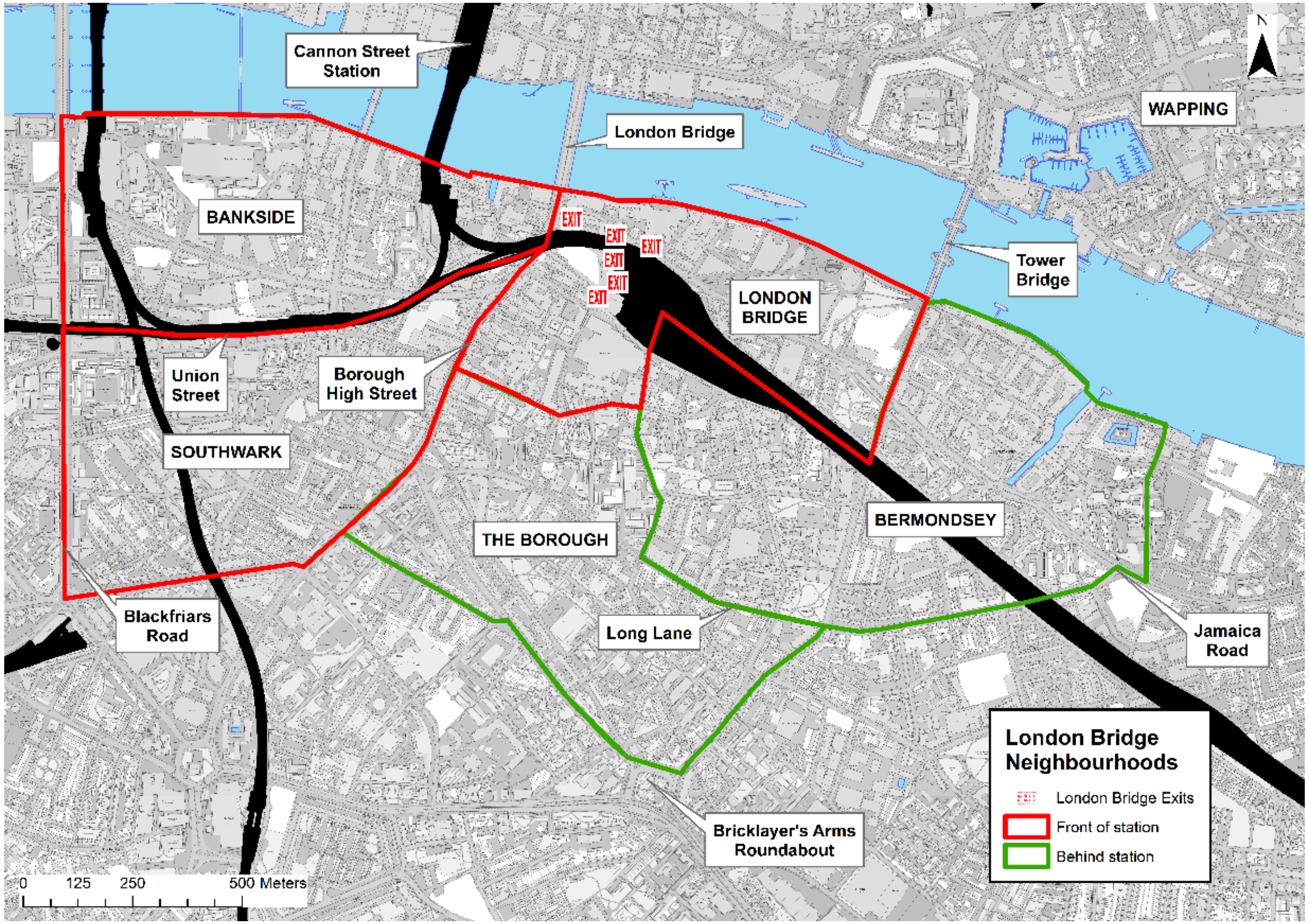

Figure 4.5: London Bridge neighbourhood boundaries.

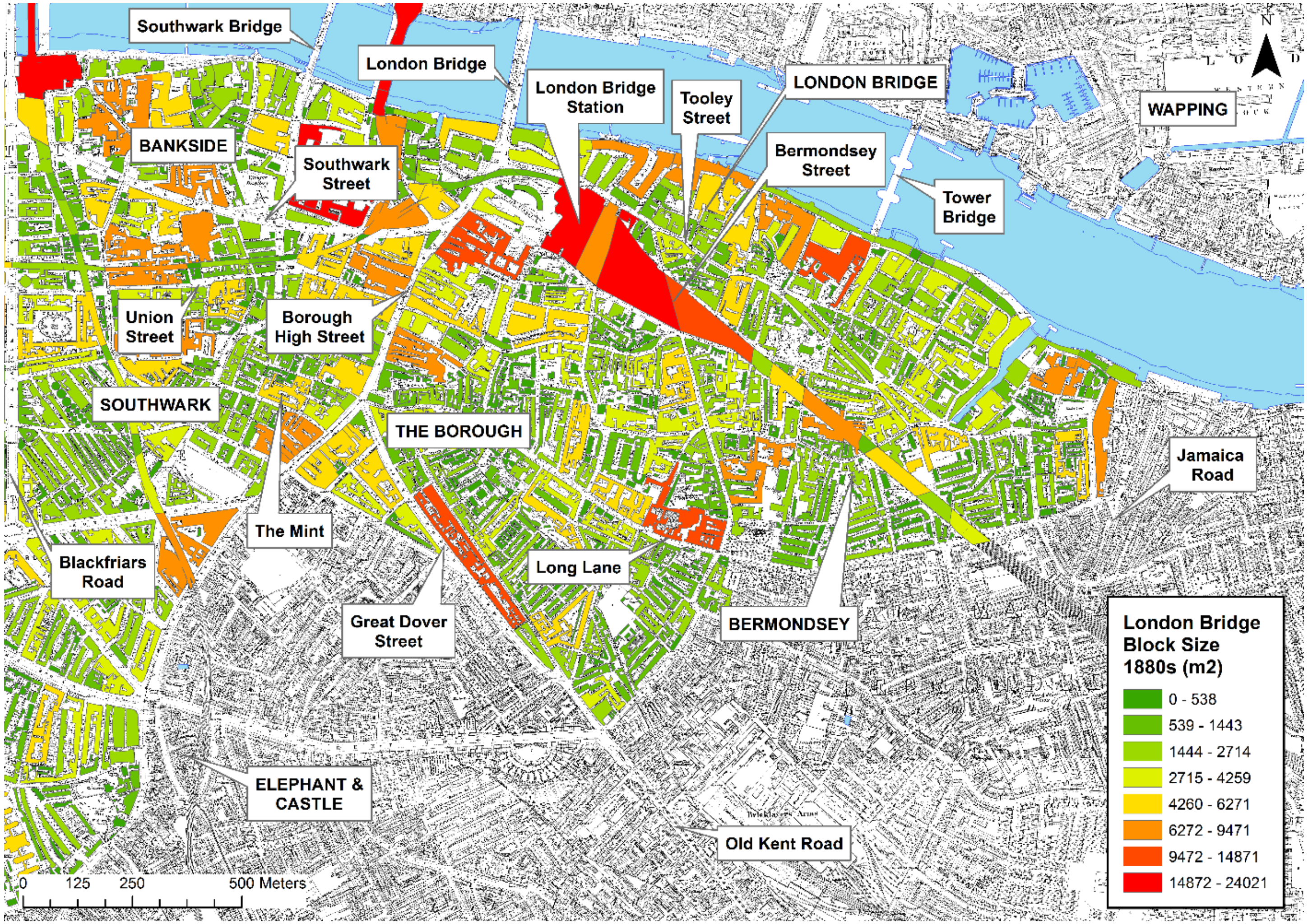

Figure 4.6: London Bridge block size, 1880s.

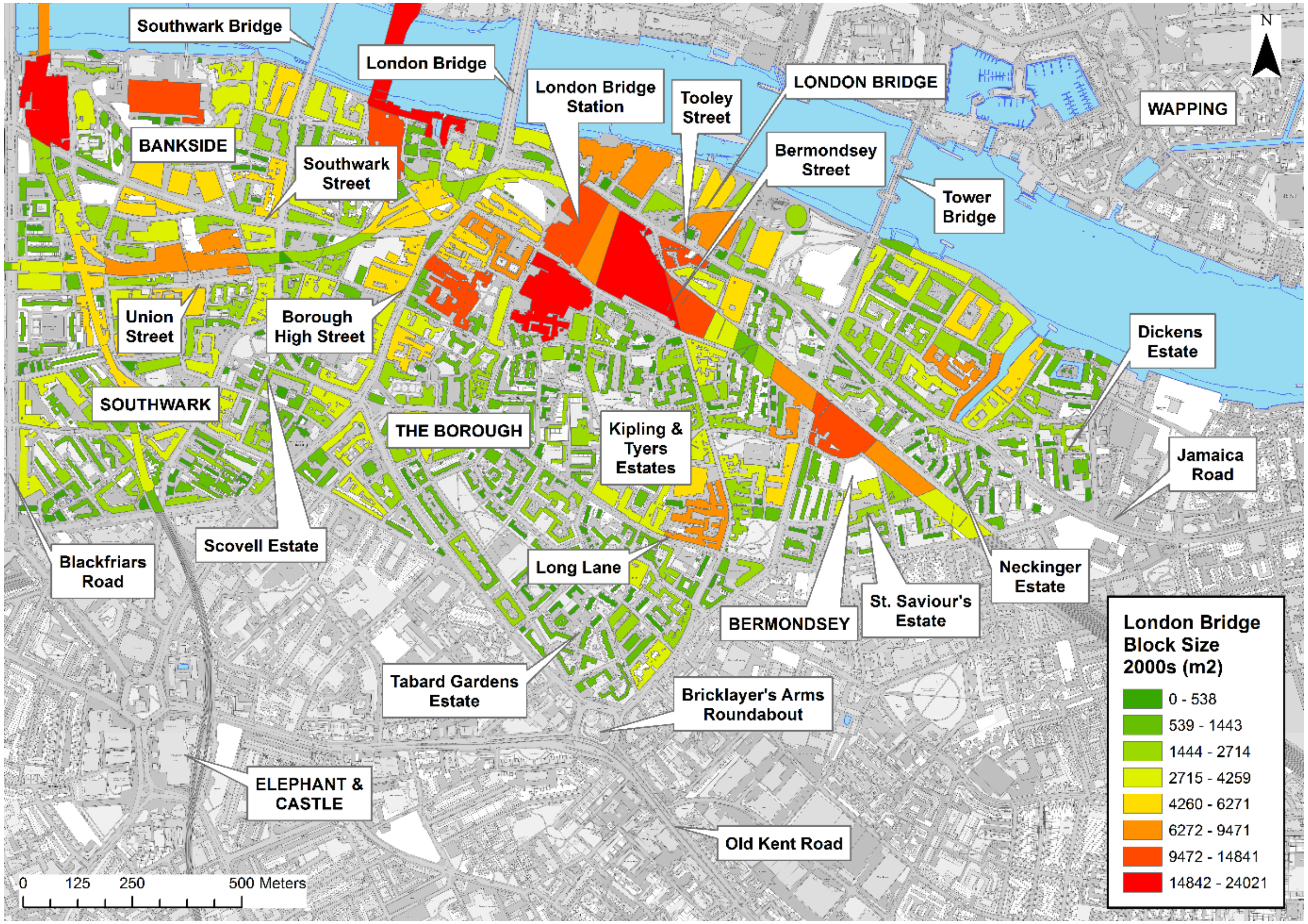

Figure 4.7: London Bridge block size, 2014.

Figures 4.6 and 4.7 shows block sizes in the London Bridge neighbourhoods analysed in both the 1880s and the 2010s (adjoining areas to the west are analysed in Chapter Eight: Waterloo Station). They allow comparisons to be made between the urban grain on either side of the station. Contrasting types of change can be seen in the neighbourhoods either side of London Bridge Station between these two periods. In the 1880s, the area between the station and the Thames was occupied by working wharves which handled much of London's food trade: perishable goods, such as dairy products, imported from northern Europe, and products processed by the many factories located in nearby Bermondsey. These wharves formed long blocks, with limited public access to the river. Wharves, along with several large breweries, extended along the full length of the south bank, from Bermondsey to Lambeth Bridge.

Large blocks of a different kind can be seen either side of Borough High Street, Long Lane and on Great Dover Street. These are particularly large because they are characterised by multiple alleyways, with few through routes, and numerous dead-end courts. Blocks of this kind were unusual in London by the late nineteenth century, relics of the medieval city. The street patterns here had existed, relatively unchanged from when Southwark was the only south bank settlement. The ancient courts of Borough High Street contained some of the most famous buildings of old London, notably the Tabard Inn of Chaucerian fame. They also encompassed some of Victorian London's best known slums including The Mint, a supposed "sanctuary for evil" (Godwin, 1854, p. 73), which was a district of poor cottages developed on the site of Henry VII's Mint; and the Great Dover Street blocks, with a reputation for "thieves, low prostitutes and bad characters of all descriptions" (Weight, 1840, p. 57) dating back at least to the early seventeenth century.

The impenetrability of The Mint was well known. The Liberty of the Mint was an island, governed separately from surrounding land until the 1720s, which had become a refuge from justice for debtors, described in works of eighteenth century literature including Daniel Defoe's Moll Flanders. Although its special status was abolished, its physical structure remained intact, and its reputation for poverty only grew. It drew the attention of journalists and social reformers during the late nineteenth century when George R. Sims, for example, wrote extensively about "the foulest and dirtiest dens in London — that awful network of hovels which lie about the Borough and the Mint" (Sims, 1889, p. 45). His choice of terminology highlights the way that the district's houses were connected, via internal passages and doors and narrow alleys rather than conventional public streets. The Mint was partially demolished in the late 1880s for the construction of the new Marshalsea Road.

The areas located behind the station, Bermondsey especially, were heavily industrialised. Bermondsey was best known for its tanneries and leather works, of which there were many in the 1880s, but was home to a range of manufacturing. This included other 'nuisance' industries such as glue works, but also the jam and biscuit factories – Hartley's, Jacob's, Peek Frean's, Spiller's - for which the area became famous during the twentieth century. Factory complexes dominated the streetscape, including areas of open tanning pits, cheek-by-jowl with rows of terraced housing.

Figure 4.7 shows the scale of change since the nineteenth century. The largest blocks still belong to the station, which has a substantially unaltered footprint, but the approach viaduct has been widened. The largest structures in the area are all railway related – blocks containing Blackfriars Station, Cannon Street Station, the viaducts and the London Road Bakerloo Line Depot – with the exception of Guy's Hospital (18,627m^2). The wharves and docks have been partly demolished, particularly west of Tower Bridge where the riverside blocks were cleared in the 1970s. The replacement development around City Hall consists of large, stand-alone blocks, set back from the river. Further west, wharves have been converted or replaced by similarly sized, riverfront offices.

Along Borough High Street some of the medieval street pattern remains, with much-altered buildings. In particular, the east side of Borough High Street retains medieval court and alleys, although very few of the buildings they contained. Further south, redevelopment has been comprehensive, and the block size has reduced. Behind the station, the large, dense blocks found in nineteenth century Bermondsey and The Borough, which combined houses and factories, have also been substantially demolished, replaced by a variety of post-war housing estates.

These housing developments were almost all built during the 1950s and 1960s, and are predominantly medium-rise blocks, of between five and seven stories. The Aylwin, Neckinger, Tabard Gardens, Lockyer and Tyers Estates are built to 1950s London County Council designs. The Dickens Estate consists of buildings from the 1950s and 1960s, and a high rise tower. The Kipling, St. Saviour's and Scovell Estates consist of 1960s deck access blocks, and the Kipling includes two towers. A number of other developments from the same era sit among the larger developments, including Hamilton Square (Image 4.3). Although they are located within the Bermondsey street grid south of London Bridge Station, these areas were all built around the principle of separating pedestrian and vehicle routes, and are accessed by ramps, cut-throughs and garage routes, creating a complicated and relatively segregated street network. These estates were all are marked in Figure 4.9.

Image 4.3: Hamilton Square, Kipling Street.

The replacement of the Bermondsey and Borough terraces and factories with housing estates has reduced the mean block size in these neighbourhoods. Figure 4.8 shows a frequency distribution analysis of blocks sizes in the 1880s and in the 2010s, calculated from the maps above. The neighbourhoods behind London Bridge Station are analysed separately from those in front, to allow comparison, using the boundaries shown in Figure 4.5.

Frequency distribution has been calculated for this and subsequent case studies, to provide further insight into the urban grain of the neighbourhoods surrounding London Bridge Station. This statistical technique has been chosen to measure the size profile of the blocks found in each neighbourhood. The aggregate number of blocks either side of the station have been divided into seven ranges, calculated using the Jenks natural breaks classification method. Jenks breaks are designed to identify and represent naturally occurring breaks in the data, to group similar values, and to maximise differences between classes. Applied here, they highlight the frequency of occurrence within each size band showing, for example, how areas with similar total block numbers can consist of contrasting size profiles.

Figure 4.8 shows that the aggregate number of blocks in both areas has fallen since the 1880s, but more so in front of the station. The total in front fell from 444 to 302 (39 per cent less) between the two periods, but behind the station it fell from 618 to 362 (20 per cent less). This reflects a thinning out of the dense, late nineteenth century morphology throughout the area, particularly during the post-war period.

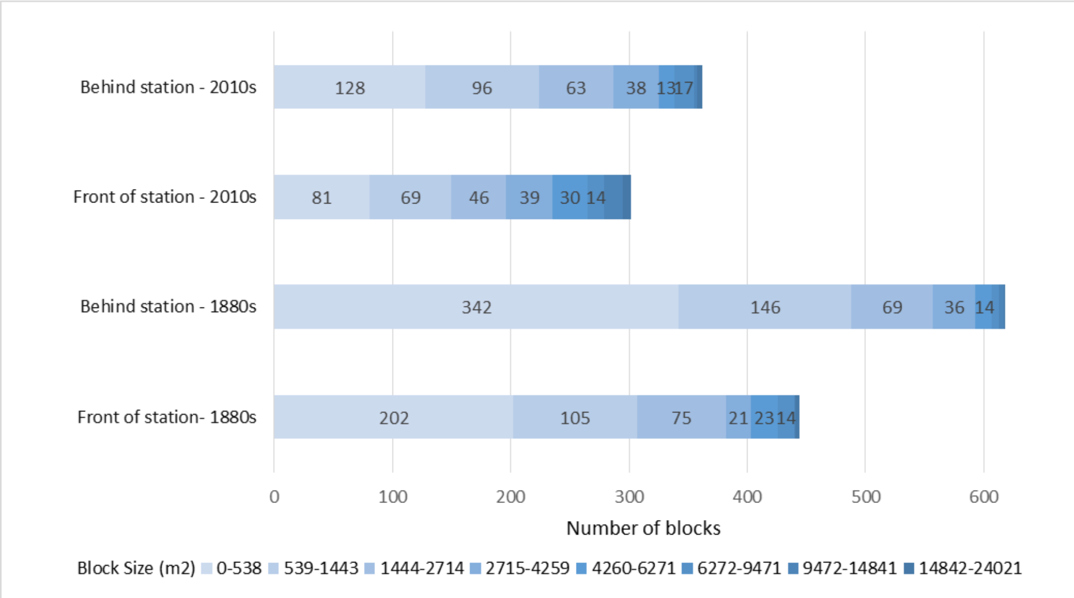

Figure 4.8: Frequency distribution of blocks by size, London Bridge, 1880s and 2010s.

The distribution shows different size profiles between the two areas, a difference found in both periods. Blocks in front of the station tend to be larger, with 23 blocks in the largest two size ranges in the 2010s, compared to seven behind the station. In both eras areas behind the station have a larger aggregate number of blocks, with 46 per cent more blocks in the three smallest size ranges both in the 1880s and in the 2010s.

These changes reflect a contrast in morphology between the front and the back of both station, which has become more exaggerated between the 1880s and the 2010s. The riverside neighbourhoods of Bankside and London Bridge have retained their large building footprints, but are now known for civic, commercial and cultural buildings rather than factories and wharves. South of the railway viaduct in Southwark there has been substantial redevelopment, but replacement blocks are of a similar size to the terraces that preceded them. In Bermondsey and The Borough, the replacement of large, industrial facilities has led to more comprehensive change, with blocks reduced in size as a consequence. The neighbourhoods are now characterised by residential estates, and by modernist estate layouts. Block size is only part of the picture, and other spatial factors need to be assessed to understand the changes that have taken place, particularly network change, connectivity and Integration.

Spatial analysis

Network change

The street networks for the station neighbourhoods have been overlaid for both the 1880s and the 2010s in Figure 4.9 It shows that, while the street pattern has remained relatively stable between the two periods, there have been major network changes in particular places and smaller ones across both areas.[20] Major changes to the street network have taken place either side of London Bridge Station. Bankside, Southwark and The Borough retain much of their late nineteenth century street pattern, a series of small, interconnected grids separated to some extent by viaducts. The Thames riverfront has seen considerable reconstruction, as riverside wharves and industries closed in the 1960s and were gradually replaced. The wall of wharves that separated the south bank from the river has been breached in several places, particularly around City Hall, and new pedestrian routes along the river opened up. It is now possible to walk along the full length of the south bank of the Thames shown in Figure 4.9, with only occasional diversions, something that was impossible before the wharves and docks closed.

South of London Bridge Station, the changes to the street network in Bermondsey and The Borough are of a different nature. They show the extent to which these neighbourhoods were rebuilt after the Second World War, introducing entirely new street patterns and replacing Victorian blocks with post-war estate layouts. Main roads remain the same, but the residential areas that they surround have been substantially remodelled.

Analysis in Table 4.1 compares street segments for neighbourhoods either side of London Bridge Station shows that total segment numbers have increased by more than 30 per cent in neighbourhoods in front of the station, but have decreased by 23 per cent in area behind. This reveals contrasting development trajectories either side of the station. The riverfront has been opened up, with many more new routes introduced through the area, part of its transition from an industrial district to part of London's central business district. This process of change, which began in the late 1970s, marked the beginning of the redevelopment of London's former docks. In Bankside and London Bridge, while more ex-industrial buildings were retained, the transformation was almost as comprehensive as in better known docklands development areas, such as Canary Wharf.

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[20] Displaying layers in this order highlights additions to the network, but conceals streets that have disappeared since the 1880s. Reversing the layers has the opposite effect. This and subsequent network change maps should therefore be understood in the context of the network change statistics which represent the complete picture of change over time.

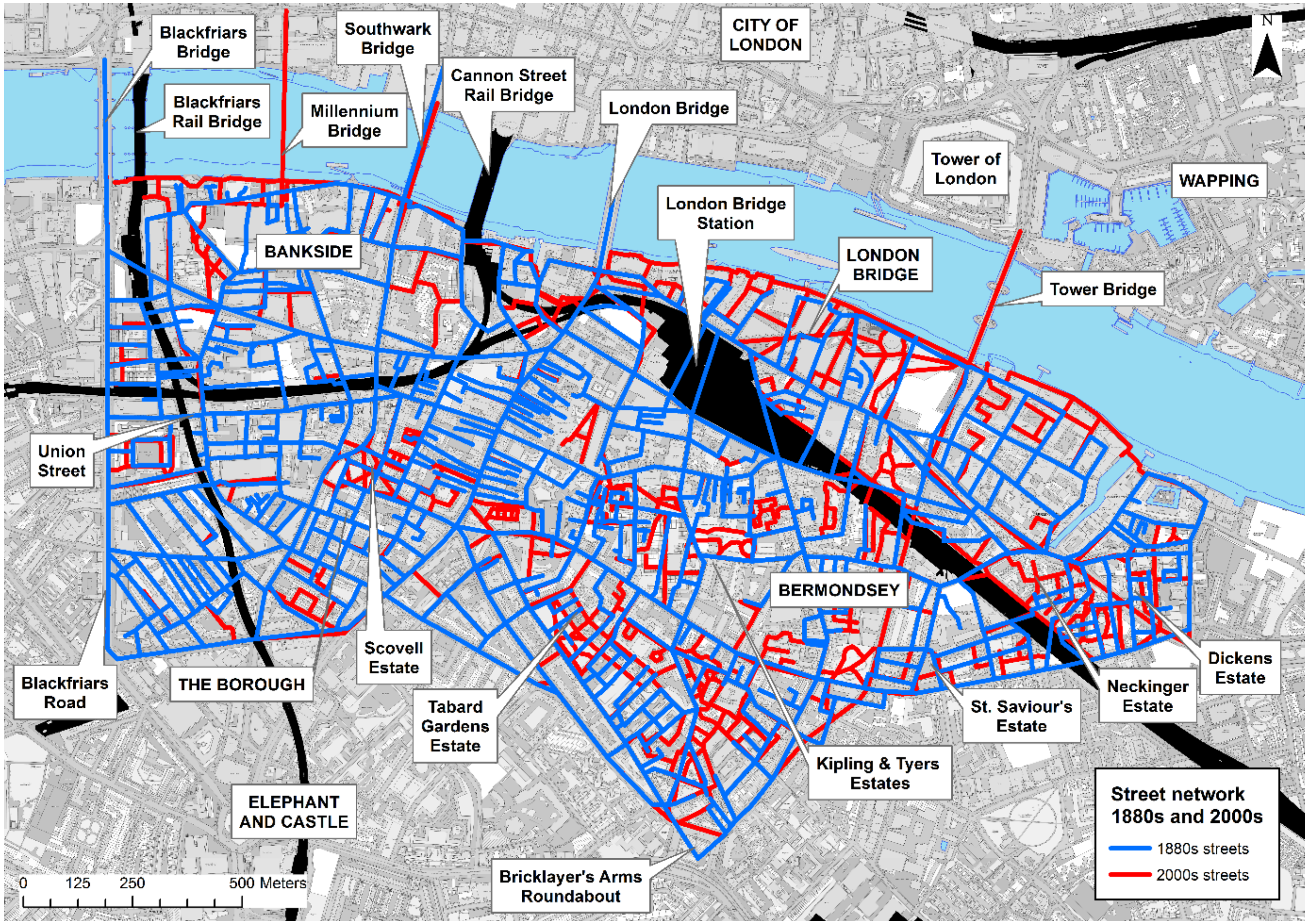

Figure 4.9: London Bridge streets 1880s and 2010s.

	Total number of segments	Mean segment length (m)	Dead ends as percentage of total segments
Station front areas			
Bankside / Southwark /London Bridge 1880s	848	43	2.2%
Bankside / Southwark / London Bridge 2014	1038	44	1.0%
Percentage change	**36%**	**1.4%**	**N/A**
Station back areas			
Bermondsey / The Borough 1880s	1153	41	3.1%
Bermondsey / The Borough 2010s	728	37	2.2%
Percentage change	**-23%**	**-9.9%**	**N/A**

Table 4.1: Street network data London Bridge, 1880s and 2010s.[21]

The decrease in total segment numbers behind the station indicates how the post-war estates reduced the complexity of the interconnected, multiple-use Victorian blocks, replacing them with a sparser but more self-contained street network, serving primarily residential development. The analysis in Figure 4.13, below, shows how well integrated streets circle these estates but do not enter them, leaving them as islands of lower Integration.

Mean segment length has remained almost unaltered in Bankside, London Bridge and Southwark, but has decreased by nearly 10 per cent behind the station. In both areas the percentage of dead ends has fallen, but dead ends still represent more than twice the proportion of the street network behind the station than in front. This means that the streets behind London Bridge form a less connected network than those in front, reflecting a

[21] Lower value of the two time periods shown in red, for ease of comparison.

difference in spatial change between these two areas. The predominance of dead-end alleys and courts apparent in the 1880s, especially off Borough High Street, has reduced but instead a more separated network has been created in Bermondsey and The Borough, including new dead ends, introduced as part of the post-war remodelling of the street network for the construction of housing estates.

Space syntax analysis

This study applies space syntax analysis to this and subsequent case studies, as a statistical measure of the spatial properties of the street networks in each neighbourhood. Two different types of space syntax measurement have been applied: Choice and Integration. Both of these measures have been shown to be effective in examining the relative integration and segregation of movement networks in many different cities (Hillier and Vaughan, 2007). Each provides a different type of information. Choice calculates the shortest path from one street segment to another for every pair of segments in a system (Turner, 2005), representing the likelihood that a street segment will receive through movement as part of a route from one place to another. Integration demonstrates the 'to-movement' potential of a space, or the likelihood that it will be visited as a destination (Hillier, 2009). Local measures of Integration have been shown to be the best predictors of economic and social activity at street level (Hillier, 2002, Vaughan *et al.*, 2005).

Space syntax analysis has been carried out across the case studies and the two time periods on a range of different scales for both Choice and Integration, from 200m to 5000m. From this range two scales – 800m and 3000m – have been chosen for discussion for each case study because they represent journeys of different lengths, from a local 800m trip likely to be made on foot, to a 3km journey which is more likely to be a journey passing through an area to another destination.

Segment maps measuring Choice at 3000m for the wider London Bridge area in the 1880s and in the 2010s are shown in Figures 4.10 and 4.11. The two maps highlight similar through routes across the area in the 1880s and the 2010s. The A3, running north-south from London Bridge along Borough High Street, has the highest Choice values on both maps. It meets another high Choice main road, the east-west New Kent Road, at Elephant and Castle. Secondary higher Choice routes run east-west along Long Lane, and north/west–south/east on Old Kent Road.

The main change to this high Choice network is the construction, in the period between the two maps, of Tower Bridge and Tower Bridge Road, built to link the bridge south, passing under the station approaches. The bridge opened in 1894, and had the effect of creating a rectangular arrangement of main through roads around London Bridge Station, also increasing Choice values on the Tooley Street-Jamaica Road east-west route. Expansion of the Elephant and Castle and Bricklayer's Arms junctions is also apparent in Figure 4.10. However, despite the introduction of the new bridge, the majority of street segments behind London Bridge Station remain lower Choice streets, in residential areas.

Comparison of mean Choice values shows that they have decreased in neighbourhoods on both sides of the station since the 1880s. However, while the extent of the change is similar at 3000m scale, it differs considerably at smaller scales. Despite the introduction of Tower Bridge, connectedness has fallen for journeys across both areas. At 400m there has been almost no change behind the station, compared to a 21 per cent reduction in front; and at 800m, the disparity is similar. This implies that, while Bankside and Southwark have become less well connected for local journeys, this effect has also occurred to a lesser extent behind the station.

While high Choice routes have increased in number and value, the connectivity of the much larger number of lower Choice routes has decreased across all areas, with the replacement of interconnected Victorian blocks and the removal of smaller through routes. However, at local level Bermondsey and The Borough have retained much of their connectivity, despite extensive rebuilding. This could be explained partly by looking at the new routes introduced along the Thames which have increased the number of segments in Bankside and London Bridge but added few higher Choice routes. Behind the station and away from the river, mean Choice values have remained much more stable.

In the 1880s, Borough High Street clearly marked the edge of a highly integrated core of streets to the west. Integration values fell closer to the industrial riverfront and to the east of the High Street, either side of the London Bridge viaduct. The station sat just beyond the edge of inner south London, marking the point where streets hosting multiple activities gave way to industrial and residential neighbourhoods. By the 2010s, the picture has changed. Integration values are now more comparable either side of Borough High Street. They have increased on segments between Long Lane and the station and on routes crossing beneath the railway viaduct. The likelihood of street segments behind the station being destinations for journeys approximating to a 10 minute walk has increased.

	Choice 3000m	Choice 800m	Choice 400m
Station front areas			
Bankside / Southwark /London Bridge 1880s	814061138	14049590	1899078
Bankside / Southwark / London Bridge 2010s	542573078	10648428	1502799
Percentage change	**-33%**	**-24%**	**-21%**
Station back areas			
Bermondsey / The Borough 1880s	585608194	12222562	1598901
Bermondsey / The Borough 2010s	425068204	11075500	1548028
Percentage change	**-27%**	**-9%**	**-3%**

Table 4.2: Mean Choice values for London Bridge, 1880s and 2010s.[22]

[22] Lower value of the two time periods shown in red, for ease of comparison.

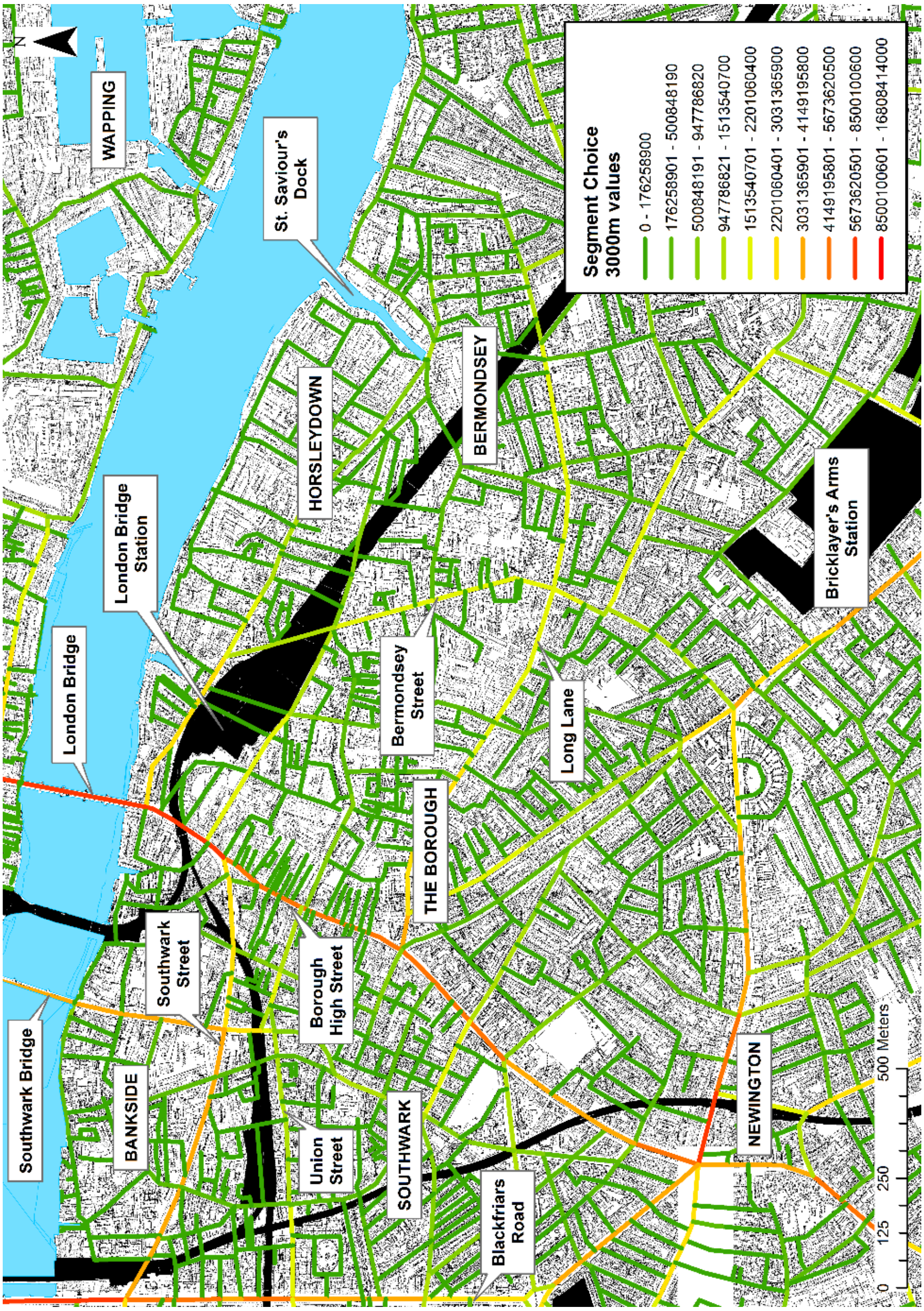

Figure 4.10: Choice 3000m London Bridge 1880s.[23]

[23] Space syntax maps throughout are © DepthmapX[Net] © 2011-2014, Tasos Varoudis. All space syntax maps shown throughout, both for the 1880s and the 2010s, are sections from the complete Inner London maps discussed in Chapter 3 - Methodology.

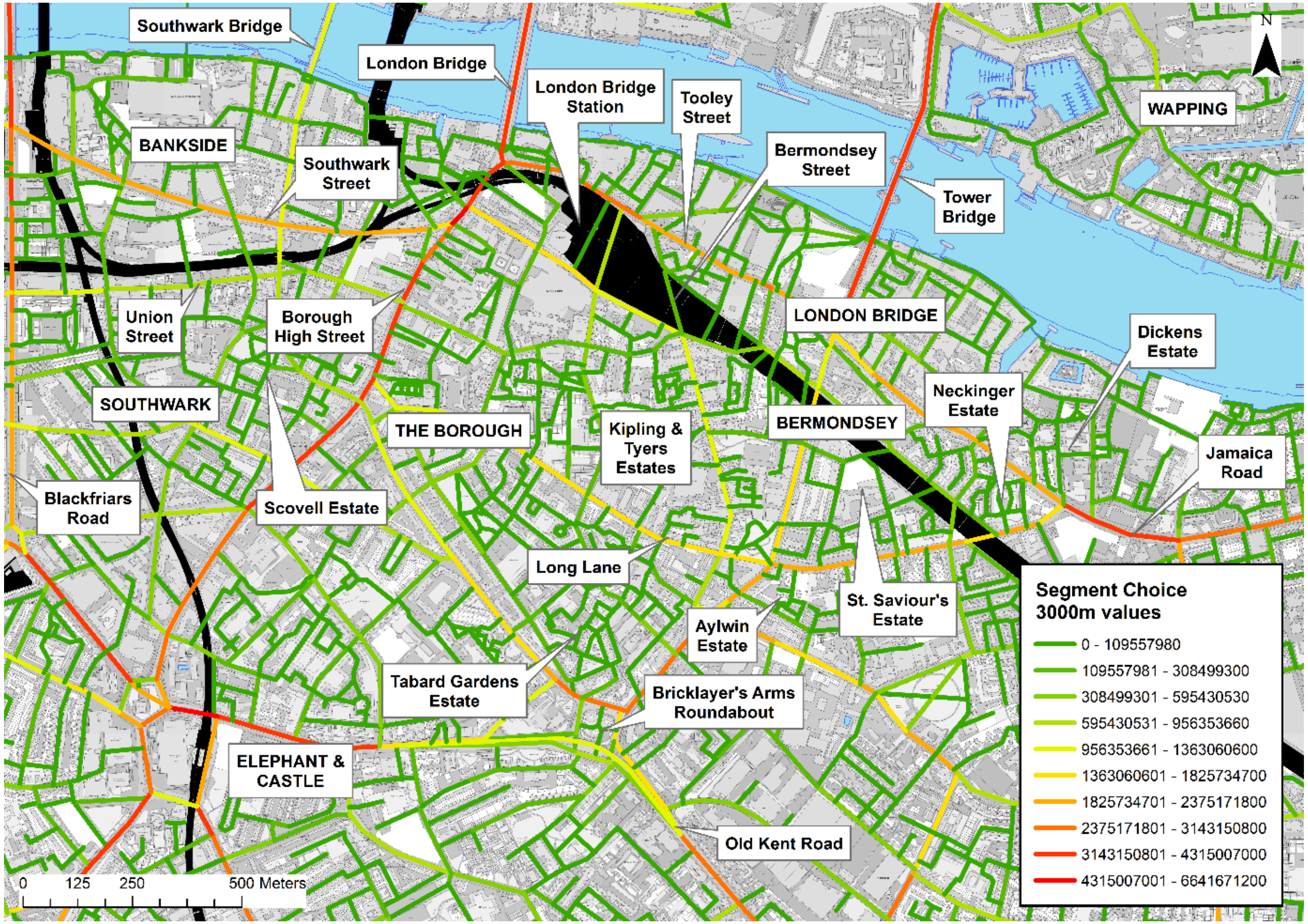

Figure 4.11: Choice 3000m London Bridge 2010s.

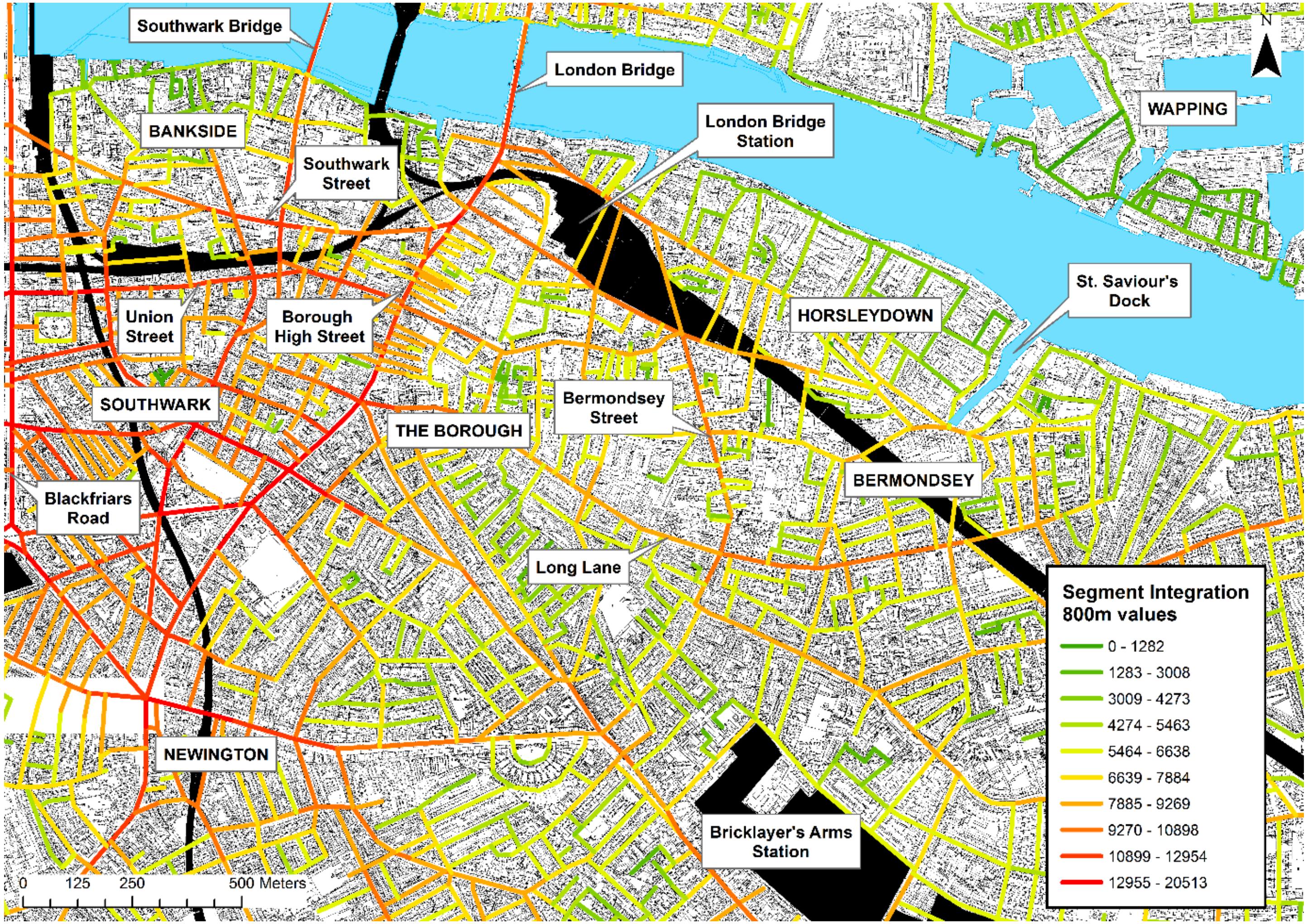

Figure 4.12: Integration 800m, London Bridge 1880s.

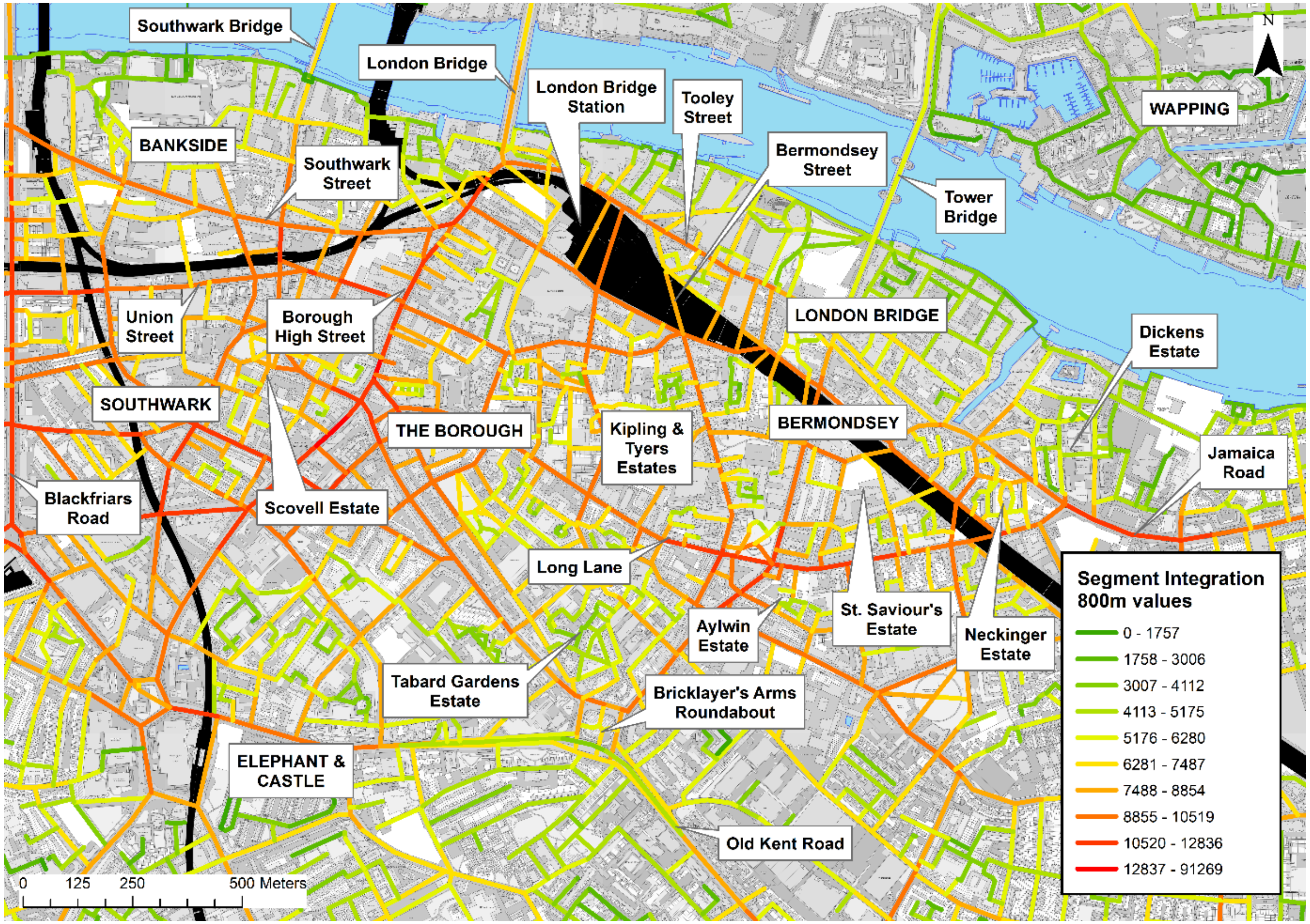

Figure 4.13: Integration 800m London Bridge 2010s.

	Integration 3000m	Integration 800m	Integration 400m
Station front areas			
Bankside / Southwark /London Bridge 1880s	63813	8353	2917
Bankside / Southwark / London Bridge 2010s	48309	7227	2555
Percentage change	**-24%**	**-13%**	**-12%**
Station back areas			
Bermondsey / The Borough 1880s	48032	6783	2420
Bermondsey / The Borough 2010s	42334	6996	2445
Percentage change	**-12%**	**3%**	**1%**

Table 4.3: Mean Integration values for London Bridge, 1880s and 2010s.[24]

Integration values are mapped in the two time periods in Figures 4.12 and 4.13. They show that the increase in Integration values across all segments behind the station has been small, and is only seen at 400m and 800m scales. However, in front of the station Integration values have fallen across scales. Just as with Choice values, there are contrasting patterns of change either side of London Bridge Station. Tower Bridge influenced the Integration of streets located between Tower Bridge Road and the station, which are no longer as isolated as they were before it was built. However, the connection across the Thames is of minimal relevance to local journeys, being too long. Instead, the new link under the viaduct via Tower Bridge Road has become a highly integrated route, and the multiple connections under the viaduct between Long Lane and the station are all associated with increased Integration values, connecting into local grids to the south of the station.

Neighbourhoods located behind terminals served by wide cuttings with few crossing points, such as Euston, Paddington and Victoria, have seen significant reductions in Integration values in during the course of the twentieth century. However, a different pattern can be

[24] Lower value of the two time periods shown in red, for ease of comparison.

observed at London Bridge. The local street network in Bermondsey and The Borough has been remodelled in a similar manner, with post-war estate layouts replacing Victorian blocks on a large scale, predominantly in poorer areas behind the station. However, these neighbourhoods have not lost Integration as a result and, instead, a well-integrated grid has been maintained, with values increasing on routes that connect under the main approach viaduct.

These tunnels are long, dirty, dark, and possibly unsafe. It might be reasonable to assume that they are unloved, and provide little amenity value. However, it seems clear that despite appearances they are in fact important local links that provide the London Bridge neighbourhoods with a level of local Integration denied to other neighbourhoods in the shadow of terminals and railway lines. The extensive network of viaducts does not result in the same 'wrong side of the tracks' effect found elsewhere London is not apparent here. Viaducts create substantial visual barriers, and are in some respects simply long, high walls. The tunnels that pass under the particularly wide viaducts found on the South Bank can be long, dark, unwelcoming and potential unsafe. However, they also offer crucial extra connectivity which results in a reduced spatial impact on their surroundings. Although they are highly visible, their impact on the neighbourhoods they cross is much less than that of more hidden, but more divisive, railway cuttings.

Land use analysis

Land uses have been mapped for this and all subsequent case studies, both in the 1880s and the 2010s. Mapping non-residential land uses for both study periods across all the case studies allowed data to be calculated measuring density and diversity. Density was measured by dividing the number of land uses by the number of segments, weighted by segment length. This produced a figure for mean uses per segment, a measure of frequency of occurrence that could be compared between neighbourhoods. Figures were also calculated for mean segment length per use, providing a different type of measure showing how far uses are clustered or separated from each other within the street network.

A further measure was applied to assess diversity of non-residential uses in each neighbourhood, and to allow land use diversity to be compared between front and back areas. The Shannon Diversity Index (also known as the Shannon-Wiener or Shannon-Weaver Index) is an entropy-based measure developed to compare species diversity between locations (Spellerberg and Fedor, 2003), but it has since been applied to land cover and land use (Huilei, Jian, Yanxu, and Yi'na, 2017; Deng, Wang, Hong and Qi, 2009). It generates a value that represents the abundance of land use types present, which increases to reflect greater diversity within a given area. It provides a means to compare overall diversity of uses within each study area, showing their relative richness in the same way ecologists measure relative biodiversity. In this thesis, the index represents diversity across the full area of each study neighbourhood.

The maps below show selected land uses for the two analysis periods, overlaid on segment maps showing Integration at 800m. In the 1880s, retail and industrial uses were the largest non-residential groups, and shops were found clustered along particular streets, principally main roads. During the 1880s, shops were distributed evenly and extensively around the station in areas away from the river. There are few retail premises along the Thames, and the riverside area is occupied almost entirely by wharves, warehouse and factories. Further south, uses become more mixed and shops are found along through routes such as Blackfriars Road, Borough High Street and Tooley Street.

Behind the station, shops are almost entirely confined to main roads such as Bermondsey Street, Long Lane and Tabard Street. The areas bounded by these through roads were filled with factories and houses, but not shops. This contrasts with Bankside and Southwark, where shops were found not just on main roads, but also on smaller streets with lower Integration values, for example Great Suffolk Street, Redcross Street and Union Street. The latter, which runs parallel and adjacent to the railway viaduct for its full length, has a particularly large number of shops. The presence of the viaduct in Bankside is not associated with any gap in retail distribution, and shops are also found on other streets that pass under the railway lines.

Figure 4.15 shows retail premises in London Bridge in 2010s. As Table 4.5 confirms, the total number of shops fell substantially between the two periods on either side of the station. The distribution of shops in these areas had also changed by the 2010s.The closure of the Thames wharves in the 1970s and 1980s led to full scale regeneration of the entire south bank of the river, and the introduction of shops in areas beside the river where they had never been before, such as between Tooley Street and the Thames. In contrast, retail has thinned out elsewhere, disappearing almost entirely from some main roads, In Southwark, shops still cluster around the railway viaduct, while streets such as Blackfriars Road have changed in character, partly due to post-war rebuilding, becoming office locations. In front of the station shops now cluster on Borough High Street and in Borough Market.

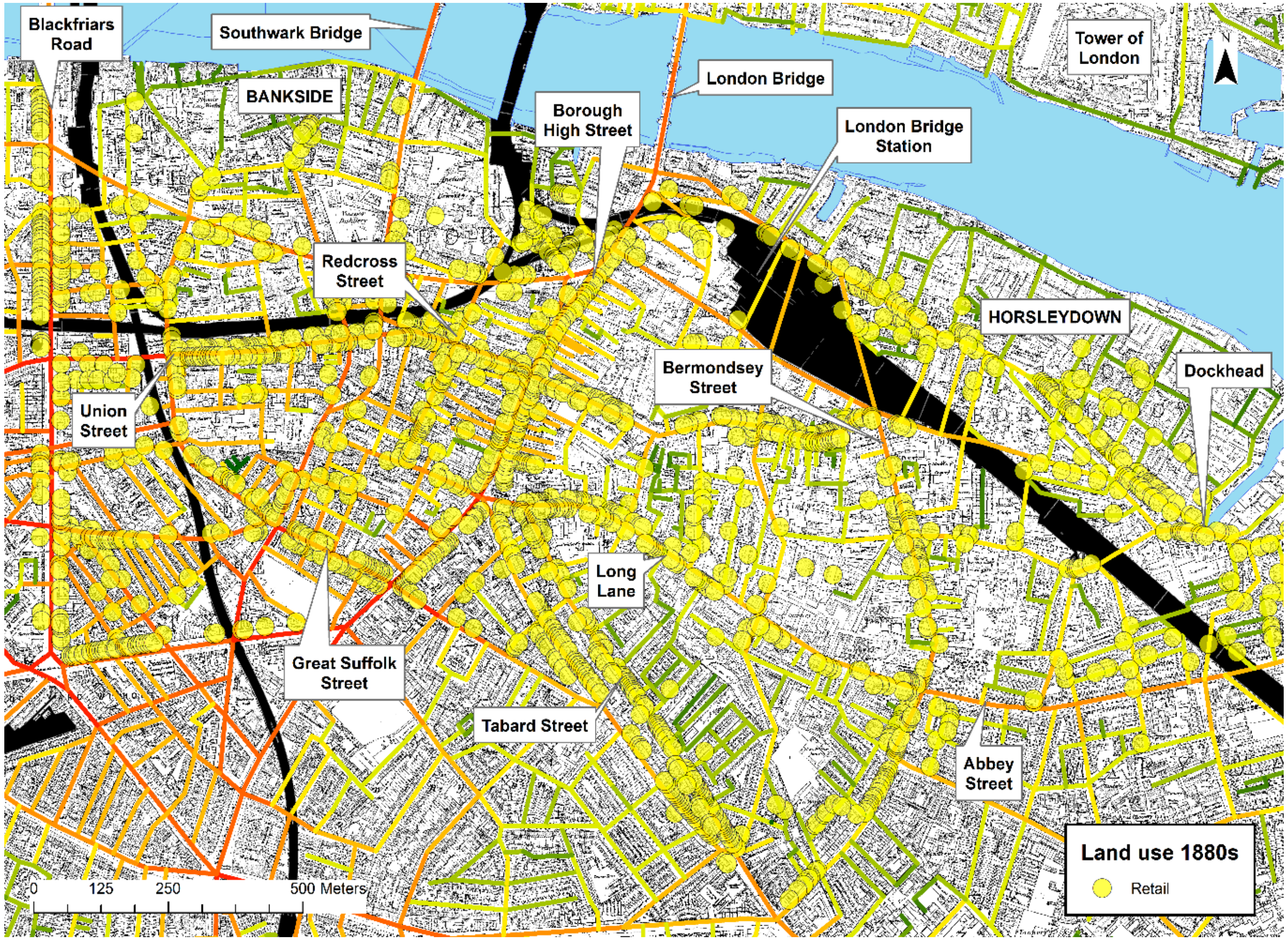

Figure 4.14: London Bridge: retail 1880s, Integration 800m.

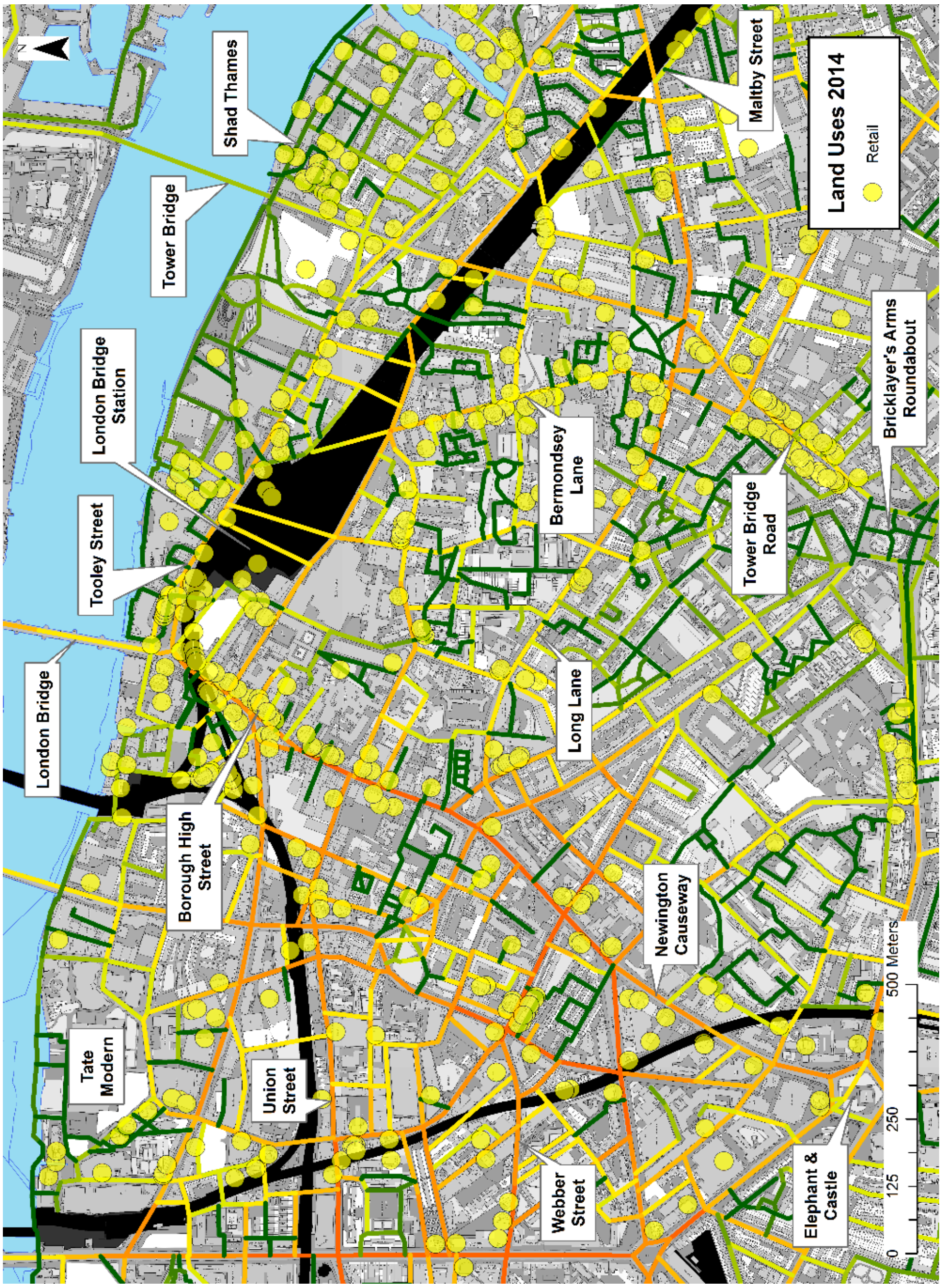

Figure 4.15: London Bridge: retail 2010s, Integration 800m.[25]

[25] This and all subsequent 2010s land use maps include Ordnance Survey AddressBase Premium data: Local Government Information House Ltd. copyright and database rights 2014. Licence number 100034829.

Image 4.4: Arches, Almond Street, Bermondsey.

The areas between main roads are far less dominated by factories than in the late nineteenth century, and have become principally residential. Behind the station, shops can be found in larger clusters in Bermondsey and The Borough, particularly on Bermondsey Lane and Tower Bridge Road. They are also found in the Bermondsey railway arches at the Maltby Street market, and elsewhere along the viaduct. The railway arches have become widely used for shops, with cafés and restaurants found throughout the area in front of the station. A few arches have been converted into office space.

Figures 4.16 and 4.17 show industrial premises only, a category that includes factories, workshops, warehouses and wharves. Bermondsey and Horsleydown were intensively industrialised neighbourhoods. In the 1880s the main streets of Bermondsey formed the outer boundaries of areas that were occupied by industrial complexes. Many belonged to tanneries, curriers and other leather businesses, often hidden behind rows of houses. Other manufacturing premises included breweries, distilleries, coopers and factories producing chocolate, cocoa white lead, dog food, floor cloths, glue, hats, jam, iron, pickles, pins, tin, vinegar and zinc. Horsleydown, beside the river, was characterised by larger wharves rather than factories, and with fewer houses. The riverfront was lined with wharves of all sizes, and flour and rice mills were also found along St. Saviour's Creek, on sites originally used by the monks of Bermondsey Abbey for tidemills.

Figure 4.16: London Bridge: industrial 1880s, Integration 800m.

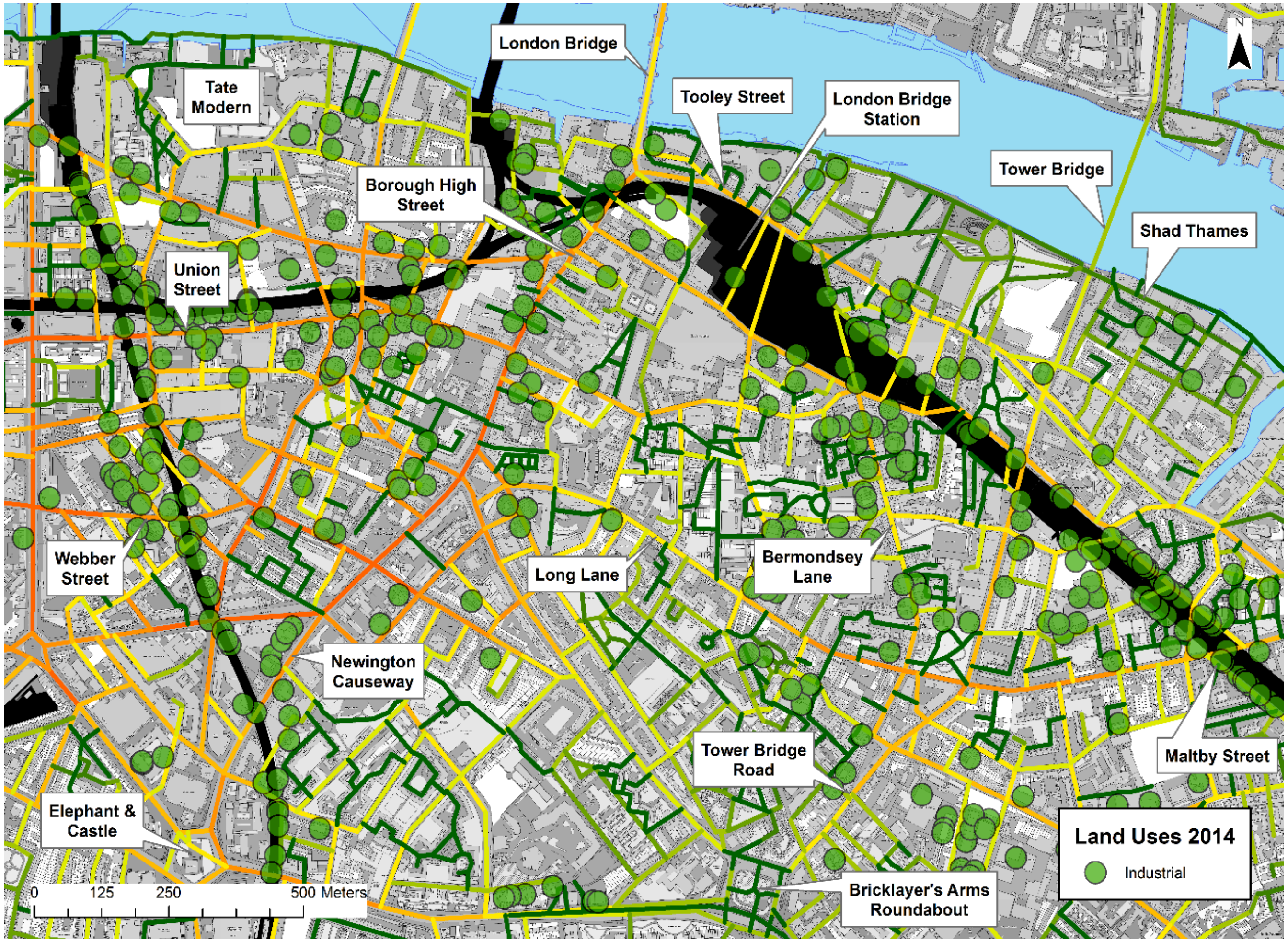

Figure 4.17: London Bridge: industrial 2010s, Integration 800m.

The Borough was also an industrial neighbourhood, but the business here was the hop trade. The Old Kent Road, the most direct route to London from the hop fields of Kent, reached London Bridge via Borough High Street. Hop warehouses, factors and exchanges occupied buildings along the east side of the High Street in the 1880s, and premises around Borough Market. Other forms of produce were also traded from warehouses around the market.

The Borough had its own localised industry too, in the form of the brush makers of Tabard Street. In and around Tabard Street brush makers lived next door to broom-men, who kept timber yards where they made broom staves. In 1733 the street was, according to Stow and Mottley, “chiefly inhabited by broom-men…” (Stow and Mottley, 1733, p. 822) and analysis of land uses in the 1880s shows that little had changed in 150 years.

Although industry was particularly clustered behind the station in Bermondsey, the industrial riverfront continued west of London Bridge through Bankside. The area either side of the railway was home to several large factories, mainly print, iron and engineering works. Further south, the streets became more residential.

The viaducts themselves provided space for manufacturing and storage. The viaduct and elevated station at London Bridge created undercroft space occupied by bonded warehouses, while space under viaducts throughout the area was used, both for warehousing and for industrial activities. The viaduct space provided storage for goods such as potatoes, eggs, cod oil, vinegar, wines and spirits. Among the businesses to be found in railway arches during the 1880s were coffee roasters, coopers, engineers, lead works, plumbers, wagon makers and wheelwrights.

Figure 4.17 shows that, by the 2010s, much of this industry had gone. As discussed, the riverside wharves had been demolished or converted and the industrial character of neighbourhoods all around the station had substantially reduced. The factories were replaced by offices, and Tables 4.4 and 4.5 show that these are now the dominant non-residential feature on both sides of the station. South of the railway lines however, it is still possible to discern the remnants of the nineteenth century pattern of industries, with clusters remaining in Bermondsey and parts of The Borough, and on either side of the viaducts crossing Southwark. It is also apparent that the railway arches now host much of the area’s industry. The viaducts behind the station, and those that cross Bankside and Southwark, are home to various types of manufacturing, from food production in Maltby Street to heavier industries further away. Businesses now found in arches range from car repair, scrap metal dealers, metal workshops and picture framers to bakeries, caterers, coffee roasters (including national chains – Costa Coffee roasts all its beans in a railway arch near Vauxhall) and, recently, micro-breweries and their tap rooms.

It is clear that the railway arches have attracted specialised uses, and now provide space suitable for industrial activity that is no longer extensively found anywhere else in these neighbourhoods. This is likely to be because rents are lower for arches than for conventional premises, due to restricted space and limited flexibility. Arches also have fewer residential neighbours, and therefore less of a problem with anti-social factors such as noise and smell.

Table 4.4 shows mean spatial values for non-residential land uses in the 1880s and 2010s.

	Mean Choice 3000m	**Mean Integration 800m**
1880s front of stations	1245150574	9243
2010s front of stations	788067437	8024
Percentage change	**-37%**	**-13%**
1880s behind stations	768968210	7437
2010s behind stations	585349972	7761
Percentage change	**-24%**	**4%**

Table 4.4: London Bridge non-residential land use values, 1880s and 2010s.[26]

Different patterns of spatial change can be seen either side of London Bridge Station, with greater falls in mean Choice and Integration values in front areas. Behind the station, while mean Choice values have fallen, mean Integration has risen, suggesting a more complex picture of change, explored further below.

Table 4.5 shows the number of non-residential land uses in the London Bridge neighbourhoods (those categories with more than ten instances in at least one of the time periods). The increase in offices and the corresponding decline in industry is clear, as these tables compare the industrial and post-industrial economies. The fall in the number of pubs between the two eras reflects wider trends but also the changing profile of the area, with fewer factory workers to patronise them.

[26] Lower value of the two time periods shown in red, for ease of comparison.

Land use		Count
Accommodation	1880s front	16
	2010s front	12
	1880s behind	4
	2010s behind	14
Eating	1880s front	80
	2010s front	118
	1880s behind	55
	2010s behind	59
Industrial	1880s front	873
	2010s front	349
	1880s behind	1017
	2010s behind	296
Offices	1880s front	144
	2010s front	1859
	1880s behind	60
	2010s behind	1312
Public houses	1880s front	184
	2010s front	56
	1880s behind	174
	2010s behind	47
Retail	1880s front	826
	2010s front	359
	1880s behind	915
	2010s behind	340

Table 4.5: London Bridge non-residential land use counts, 1880s and 2010s.[27]

Despite the long-standing presence of the railway in the area, there were very few hotels in the 1880s and although there are a few more today, based in larger premises, there are not enough to suggest a dominant rationale for the station neighbourhood.

[27] Lower value of the two time periods shown in red, for ease of comparison.

Table 4.5 also shows different trends in front of the station and behind. Mean segment length increased in front of the station, with the clearance of the Mint and the reconfiguring of riverside areas. Behind the station it fell by a small amount. The rebuilding of residential areas and the introduction of post-war estates might have been expected to result in a bigger drop in segment length, as seen in other areas in this study. However, the overall impact has been limited, suggesting that neighbourhoods around the station retain a spatial balance similar to that found in the 1880s.

Mean choice at 3000m has fallen more significantly since the 1880s, by 24 per cent behind the station and 37 per cent in front. This is the case despite major changes to the road system in the late nineteenth century, intended to improve connectivity: the building of Tower Bridge and Tower Bridge Road, and the construction of Marshalsea Road through the Mint. Despite these changes, non-residential uses are, with the exception of hotels and other accommodation, now found on less well connected streets.

Mean values for Integration at 800m have changed in different ways either side of the station, falling in front but rising behind. This disparity indicates a difference in the way the two areas have developed spatially. Again, although large-scale estate building has occurred behind the station, non-residential uses are now located on segments that are more likely to be destinations for local journeys. Redevelopment of the riverside, where streets between the railway and the river are less integrated than those further south, contributed to this fall.

	Mean uses per segment (weighted by segment length)	**Mean segment length per use (m)**	**Shannon Diversity Index**
1880s front of station	11.3	21.5	1.3
2010s front of station	18.7	17.9	1.1
Percentage change	**66%**	**-17%**	**-21%**
1880s behind station	20.9	21.5	1.2
2010s behind station	15.5	21.5	1.1
Percentage change	**-26%**	**0%**	**-6%**

Table 4.6: London Bridge non-residential land use density, 1880s and 2010s.[28]

[28] Lower value of the two time periods shown in red, for ease of comparison.

Table 4.6 shows substantial differences in the way each area has changed. In front of the station the mean number of uses per segment has increased by 66 per cent since the 1880s, while mean segment length per use has fallen. This describes a situation in which industries requiring large amounts of space, such as wharves and warehouses, have been replaced by knowledge industry functions such as financial services and media, which require much less space. Industries of different types have been shown to exist in parts of London with contrasting spatial characteristics, and local street Integration has been linked to the development of knowledge industry functions (Narvaez Zertuche, Davis, Griffiths, Dino and Vaughan 2017). While overall Integration has reduced in neighbourhoods in front of London Bridge, the reconnection of the routes along the Thames which were previously blocked by wharves may be a contributory factor to the arrival of knowledge businesses in this area.

Density of uses is therefore much higher in front areas than it was in the 1880s, but this is driven almost entirely by the introduction of offices. Behind the station the density of non-residential uses has fallen, with mean uses per segment falling by a quarter and mean segment length per use unchanged. These areas have become more residential since the 1880s, and frequency with which other uses are found has reduced. This is reflected in the Shannon diversity index, which shows a fall in land use diversity behind the station. However, the fall in front of the station is much greater, suggesting that the range of use types required to serve the wharf functions previously found between London Bridge and the Thames was wider than that now found in the redeveloped commercial and civic quarter. There is now no appreciable difference in diversity between front and back areas.

Social analysis

Social analysis has been carried out for the London Bridge neighbourhoods, using separate methods for the late nineteenth century and for the early twenty-first century. Figure 4.18 shows the socio-economic categories used by Booth to classify street segments. This is the key to Figure 4.19, the 1898 Booth map of London Bridge, and to all the Booth maps shown in subsequent chapters.

Figure 4.18: Key to Charles Booth Poverty Survey maps.[29]

The Booth map reveals the neighbourhoods around London Bridge Station as both semi-industrial, and relatively poor. Figure 4.19 does not include any streets in Booth's highest social classification, Yellow (Wealthy), and only 12 per cent in the Red (Middle-class) category. The areas on the map lacking any colour, both along the riverfront and south of the station in Bermondsey and The Borough, reflect the presence of non-domestic buildings. There was a concentration of manufacturing industries, many operating from small factories, which were distributed among residential streets, and a ribbon of dock activity along the Thames with wharves of varying sizes, dominating the riverfront.

The waterfront at Horsleydown and London Bridge Station was known as 'London's Larder' until the Second World War because it was a centre both for food imports and for produce, which was traded wholesale at Borough Market. The station was located at the centre of a

[29] Source: Charles Booth Online Archive, London School of Economics.

mixed, working area, only yards from the river and the market. The station frontage was set back from Borough High Street, and the Booth Survey describes both Railway Approach and Tooley Street as occupied by warehouses.

The only Red (Middle Class) areas on the map were found along main roads, particularly Borough High Street. However, this was a working street too. Many of the courts were given over to hop factors (dealers in hops, delivered from Kent), small factories and warehouses storing vegetables for Borough Market. The railway had a presence on the high street, and its arrival had resulted in demolition of medieval courtyards. Booth's researcher notes that the George Inn was "not so large as formerly, as its E side is given up to Railway offices. GNR goods yard at E end" (Booth, 1902, B364 p. 177).[30] However, despite its higher social status Borough High Street was described, along with Clapham Common, as the favourite haunt south of the river of "prostitutes and bullies" (i.e. pimps) (Booth, 1902, B364 p. 177).

South and east of the station, in Bermondsey and The Borough, the survey noted the growth of factories located close to sources of local, cheap labour. There were specific, hyper-local industries – for example, fish-curing on Delph Street and brush-making on Tabard Street – and many people were employed as unskilled labourers at Borough Market and the GNR Goods Yard. A house on Long Lane where servants are kept was described as "exceptional" (Booth, 1902, B364 p. 27).

The blocks north-east of Great Dover Street contained the largest concentration of Black (Lowest), Dark Blue (Very Poor) and Light Blue (Poor). Tabard Street consisted mainly of "rooms for single nights and short periods… much used by prostitutes and shady people generally" (Booth, 1902, B364 pp. 20-21). However, the area was not a no-go zone, and a mixture of activities can be found: "Vice, poverty and business jostle as usual in the street" (Booth, 1902, B364 p. 21).

The entire area to the west of Figure 4.19, bounded by Blackfriars Road, Borough Road, Borough High Street and Union Street was condemned in the strongest terms by Booth's surveyor, who judged it to be "a set of courts and small streets which for number, viciousness, poverty and crowding is unrivalled in anything I have hitherto seen in London" (Booth, 1902, B363 p. 171).

[30] All quotations from the Booth notebooks reproduce the note-style grammar and punctuation of the originals.

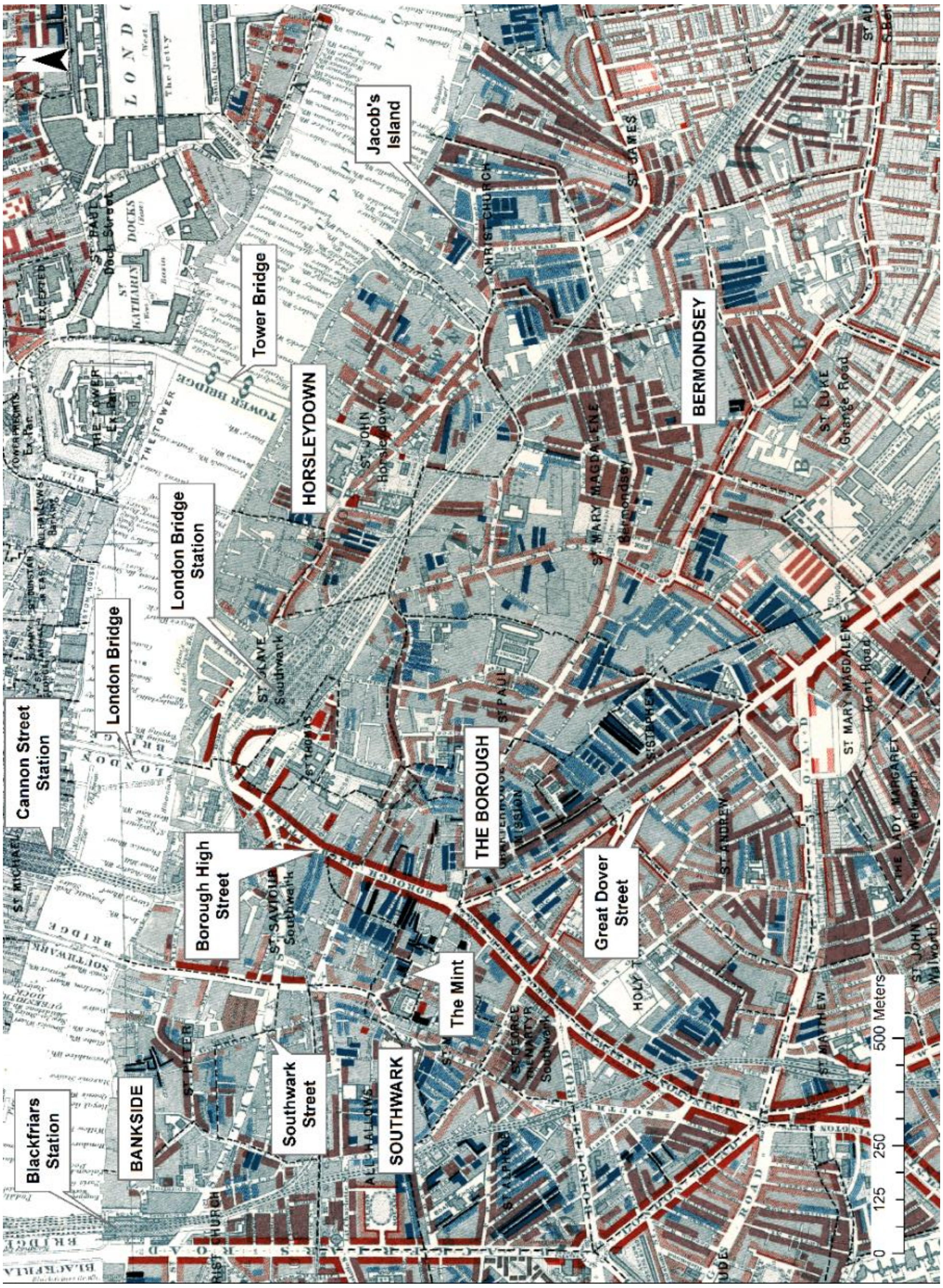

Figure 4.19: London Bridge 1898, Charles Booth Survey map. [31]

[31] Source: Charles Booth Online Archive, London School of Economics. Labels added for the purposes of this study.

Courts between Borough High Street and Redcross Street were “a bad quarter” (Booth, 1902, B363 pp. 212-213), and this was related directly to design factors in one of the oldest, unchanged parts of Southwark. The buildings were described as “so badly planned that they never can be well managed. The dark staircases harbour ruffians at night. Miss Sheepshanks said that they were so dark that by day you could not see the numbers on the doors” (Booth, 1902, B363 p. 215).

The surveyor, who wrote that this area of Southwark was “probably the most serious blot on the map for all London (excepting only the Tabard Street area)” (Booth, 1902, B363 p. 171). He believed that an explanation for the condition of the whole district lay in the demolitions that had taken place nearby. While these streets had remained relatively unaltered in the decade since the previous survey, people had been displaced to this area from streets cleared around the boundaries. These changes included demolitions for railway extension work, and for the building of factories and a hospital.

Closer to the rivers, there were relatively few houses in Bankside, among breweries, gas works and wharves. Those that remained were poor, for example Moss Alley which was black on the map and described as “rotten dark courts… some thieves, snatches, vandraggers” [men who steal from vans] (Booth, 1902, B363 pp. 168-169). This was an island surrounded by industry, “a little village by itself: men employed in Phoenix Gas Works” (Booth, 1902, B363 p. 169).

Further poverty was described in areas behind the station, with Bermondsey as a whole recorded as a poor area. Near Shad Thames there was “dirt; squalid children... all the signs to make one suspect that this out of the world corner of London is also one of its most drunken and low-lived spots” (Booth, 1902, B364 p. 75). Bermondsey had many tanneries and fell-mongers’ yards (dealers in hides), which involved unpleasant work. This was recorded vividly by the surveyor, who caught glimpses of women in yards skinning piles of sheep’s heads, and described the noxious smell of the tanneries hanging over the whole area.

Much of the area was dominated by demolition and construction work for the railway, and by the construction of Tower Bridge, which was then underway. The bridge opened in 1899, and required demolition of wharves and houses to build a new approach road through Bermondsey to the river. The survey reported that “The Tower Bridge has had, and is destined to have, a considerable effect on this n’hood” (Booth, 1902, B364 pp. 68-69). Meanwhile, “The widening of the S.E.R… will be found to be a source of alterations at many points along this north side of the railway” (Booth, 1902, B364 p. 79).

The viaduct was “being extended E. but is at the same time being converted into a kind of cryptic way, its arches supporting, not a Church, but a railroad” (Booth, 1902, B364 p. 79). Streets where demolitions had occurred were described as “a centre of desolation and squalor” (Booth, 1902, B364 p. 83) or having “a general air of unsettlement” (Booth, 1902, B364 p. 83). Church Row, near the parish church of St. James’s, Bermondsey behind the station “ought to be a pretty and refreshing spot, but the railway extension is disturbing it, and a good many of the houses have gone” (Booth, 1902, B364 p. 83). The survey noted the long-term effect of the new infrastructure on the area, resulting in areas left over and abandoned: “Demolition not followed by rebuilding, has been always due either to the Bridge or to the Railway” (Booth, 1902, B364 p. 89). Local displacement from the railway works was also apparent. A group of women comment, as the surveyor and accompanying policeman pass by, “Goin’ to turn us out of our ‘ouses? Y’ll ‘ave to find us some if you do” (Booth, 1902, B364 p. 107).

The Booth survey also noted a process of depopulation taking place in the wider area around London Bridge, similar to that described as having already taken place in the City of London. The areas close to the river and the station were becoming dominated by factories and businesses, and those residents with a choice were moving elsewhere. The rich had already left, and “those who properly can least afford to pay high rents are the last to leave” (Booth, 1902, B364 p. 178). The poor and the very poor remain, “and will remain until they are evicted” (Booth, 1902, B364 p. 178).

Table 4.7 links spatial data for London Bridge to the Booth categories. The social profile of the areas either side of the station is comparable, but there is a large proportion of Pink and Purple streets behind, and a greater proportion of the poorest categories in front. There are consistent spatial differences between the front and the back of the station. Mean segment length is shorter in front of the station for all categories except the lowest two. Choice values at 3000m are lower behind the station than in front, except again for Dark Blue and Black categories. Across all categories segments behind the station are less well integrated than those in front.

These patterns demonstrate difference social profiles, depending on the relationship of segments to the station. Although those parts of Southwark in front of the station are highlighted in the Booth survey as particularly poor, their mean Choice values are higher than areas behind the station. The highest values are found on Red (Middle Class) streets, which is unsurprising as they are all main roads. Choice values then drop with social category, except for Black streets which have higher values.

		Count	Segment Length	Choice 3000m	Integration 800m
Red: middle class	**Front**	423	46	1941667572	8984
	Back	521	51	1502787882	8303
Pink: fairly comfortable	**Front**	617	34	538751914	6867
	Back	1052	48	536599455	6645
Purple: mixed	**Front**	656	43	332324606	7114
	Back	1094	48	317125239	6173
Light Blue: poor	**Front**	678	36	254195635	6741
	Back	715	38	237952642	5050
Dark Blue: very poor	**Front**	348	39	134507349	6099
	Back	442	38	135236971	4627
Black: lowest class	**Front**	166	47	211169487	6645
	Back	119	46	392790802	5547

Table 4.7: Mean spatial data and Booth, London Bridge 1898.[32]

Exactly the same pattern is seen behind the station, but Choice values are all lower than for segments in front. The rise in values for the lowest category is a phenomenon identified by Vaughan and Geddes in their study of the spatial patterning of poverty in 1880s East London, also based on the Booth Survey (Vaughan and Geddes, 2009). However, streets behind the station are less well connected. These areas are further from cross-river routes with, before Tower Bridge, no permanent river crossings east of London Bridge, these values reflect their relative lack of connectivity.

The pattern for Integration values at 800m across the categories is less clear. The most integrated segments in all neighbourhoods are Red, but values fluctuate across the remaining categories. The most consistent pattern is the lower Integration values found behind the station in all categories.

[32] Lower value of the two time periods shown in red, for ease of comparison.

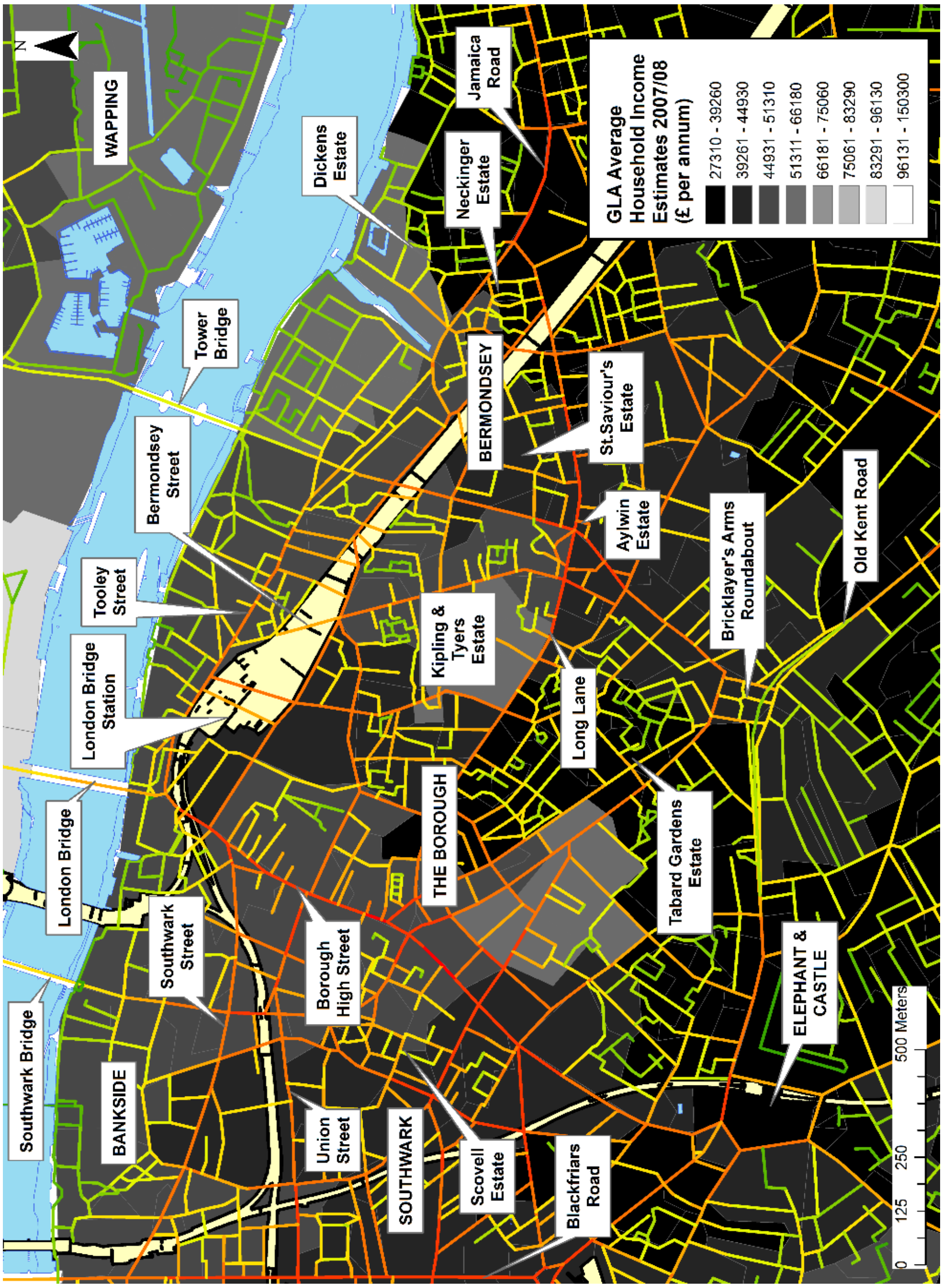

Figure 4.20: London Bridge, GLA Household Income 2007/08, Integration 800m.[33]

[33] All GLA Household Income Estimate data is © Census Information Scheme. Adapted from data from the Office for National Statistics licensed under the Open Government Licence v.1.0.

The income profile of all the areas shown in Figure 4.20 is lower than around any other London terminals included in this research. No Lower Super Output Areas (LSOAs) around the station fall within the top four income categories. The areas with the highest incomes are found in a few specific areas: the riverfront east of Tower Bridge; an area north of Long Lane around the Kipling and Tyers Estates; and a third area south of the junction of Borough High Street and Long Lane, north of the Tabard Gardens Estate. All these areas fall within the £51,311-£66,180 household income bracket, and have more of a concentration of privately owned housing than areas nearby. The riverside neighbourhood east of Tower Bridge, either side of St. Saviour's Dock, was one of the first dock areas to be regenerated, with warehouse conversions during the late 1980s around Shad Thames and Butler's Wharf.

Although the overall income profile around the station is relatively low, there are variations within the income range. Bermondsey and areas to the south have LSOAs primarily in the lower income ranges, while areas nearer the river and further to the east are home to higher income LSOAs. There is an apparently connection between the lowest category and the presence of several post-war local authority estates, and in some places a clear income division at their boundaries. For example, where the Dickens Estate gives way to converted warehouses to its north, a sharp category change is apparent. However, there is no clear separation of this kind around the approaches to London Bridge Station. Whereas the railway lines behind other London terminals divide wealthy areas from poor, the viaduct does not appear to have the same effect.

Table 4.8 shows spatial data by estimated income band. A segment map was joined to the GLA LSOA data to allow spatial analysis, with each street segment allocated the income band values of the LSOA (or LSOAs) through which it passes. The pattern of Choice and Integration values are to some extent comparable with those for the Booth Poverty Survey (Table 4.7). However, the difference in values between neighbourhoods in front of the station and behind is complex. A much greater number of segments fall into the lower two income categories behind than in front. However, there are also more segments in the £51,311-£66,180 bracket behind the station than in front, reflecting the presence of higher income enclaves. The particularly high Choice values in the highest income bracket in front of the station can be discounted, as they only relate to six segments. Segments behind the station in the lowest category are on average the least well integrated (again discounting small samples). However, spatial differences between front and back are not as clearly defined as in other station areas, just as in Figure 4.21.

Mean household income estimate	Neighbourhood	No of segments	Mean Segment Length	Mean Choice 3000m	Mean Integration 800m
£66,180-£51,301	Front	6	44	2262660223	6055
	Back	265	48	325903187	5879
£51,300-£44,931	Front	348	40	553243952	7062
	Back	198	39	571076758	7436
£44,930-£39,261	Front	336	48	541706969	7758
	Back	794	44	476318983	7793
<£39,260	Front	10	40	159627294	7945
	Back	278	40	301418943	6549

Table 4.8: London Bridge GLA Household Income 2007/08 with spatial data.[34]

Income data from the 1880s and the 2010s reveals, to some extent, a relatively unchanged picture. Areas with relatively low incomes in the late nineteenth century remain so. Areas of relative poverty are still found predominantly behind the station in Bermondsey and The Borough, and in front of the station in central Southwark. The main change that has taken place is the disappearance of industries and the residential conversion of former industrial buildings, often occupied by higher income residents. This means that more people now live closer to London Bridge Station, and these areas are now wealthier.

Meanwhile, areas of poor housing identified by the Booth Survey have been largely replaced, often with council housing. Behind the station there are many such estates, most of which are still the location for LSOAs in the lowest two income brackets. However, mean income levels have increased in areas of Bermondsey closest to the station.

[34] Lower value of the two time periods shown in red, for ease of comparison.

Discussion and conclusions

London Bridge Station was built within an established settlement surrounded by open countryside, poorly drained. This combination of circumstances led to the pioneering use of a viaduct to carry the railway lines and the station above street level. Not only could the lines be constructed in a straight line across the fields of outer Bermondsey and Deptford, but they could be carried into the heart of the densely built-up Borough and Southwark with less demolition, fewer street closures and lower costs. Although some demolition was required on the station site, the new structures were largely constructed over the existing street network. Despite creating an obvious visual blockage across large areas of south London, the viaducts permitted streets to remain open and therefore formed much less of a network barrier. It is possible therefore that, despite immediate appearances, viaducts do create the same separation as cuttings or embankments, with fewer crossing points for streets.

The viaduct system remains in place, converging on Bankside, Bermondsey, Southwark, but its complex structures have not divided these neighbourhoods in the way that cuttings and grade railways have done elsewhere in London. These neighbourhoods have become characterised by the distinctive, London stock brick arches which form unusually shaped junctions and spaces which change with each street the viaduct crosses. The most popular twenty-first century visitor attraction in the London Bridge area, Borough Market, owes its warren-like atmosphere to its position under the viaducts. The urban character of inner south London is greatly enhanced by the contribution of the railway, which is not something that can be said of the railway approaches to any other London terminus apart from Waterloo, also served by viaducts.

The railway arches have also become well-used spaces. A side effect of the structural needs of the viaducts, they have often gone unnoticed, seen as dirty, seedy, or even dangerous and located precisely where train passengers cannot see them. However, the analysis above shows that they are now the prime industrial spaces in the London Bridge area, where the manufacturing traditions of Bermondsey continue. Many of these businesses are different to those housed in the arches in the 1880s, but there is also continuity through activities such as brewing and coffee roasting. The arches provide functional spaces, with limited flexibility for conversion into different uses. As noisy places, they are ideal for noisy activities, although increasingly valued as bars and restaurants.

The urban grain has changed in different ways either side of London Bridge. The replacement of terraces and factories with estates has reduced mean block size, and created a more separated street network of shorter segments. However, this extensive remodelling has not had the effects seen in similarly rebuilt areas behind terminals which are separated by cuttings or grade railways such as at Euston or Paddington Stations. Although housing estates remain to some extent islands, there is no stark contrast in space syntax values with areas in front of the station. Local scale Integration has actually increased behind the station and, while non-residential uses have decreased this has not resulted in a sparser distribution of land uses overall, with residential uses filling the gaps.

Viaducts do not reduce Integration values in themselves. The network of streets west of Borough High Street are highly integrated despite the presence of railway viaducts crossing the entire area. Behind London Bridge, Integration values fall with distance from Borough High Street. This suggests that areas behind the station are more separated than those in front, but the viaducts in Southwark do not have the same effect on local Integration values, so it is unlikely that the viaduct alone is responsible. Relative income levels reflect the patterns of the nineteenth century, with poorer areas found on both sides of the station. Where income levels have increased, they have done so close to London Bridge and to areas immediately behind the station. The viaduct does not appear to play a clear role in separating richer from poorer areas.

The next chapter analyses the next terminus to be constructed – Euston Station, built shortly after London Bridge – alongside King's Cross and St. Pancras Stations, which are located in close proximity on the same main road.

Chapter Five: Euston, King's Cross and St. Pancras Stations

Introduction

Three of London's railway terminals are lined up along a 750m stretch of Euston Road, mapped in Figure 5.1. Behind the stations, several lines intersect to create a complex series of junctions as connect with cross-London routes. The area between Euston Road and Camden Town, 1.75km to the north, contains several distinct neighbourhoods separated from each other by networks of railway land and railway lines, carried in a combination of cuttings, viaducts and tunnels. The Regent's Canal introduces a further layer of infrastructure, passing both under and over the railways. The neighbourhoods behind the three terminals appear as a series of islands among the infrastructure, enclosed by railway lines and the Regent's Canal, with Regent's Park to the west and the Euston Road urban ring road as the southern border. This contrasts with neighbourhoods directly in front of the three terminals to the south, deliberately kept train-free during the mid-nineteenth railway century boom, with stations and lines all built beyond the boundaries of the Bedford Estate's Bloomsbury land.

History

Euston Station opened in 1837, built by the London and Birmingham Railway Company as London's first mainline terminus, in contrast to the local services offered at London Bridge Station, which had opened a year earlier. It carried passengers all the way to Birmingham where connections could be made to Manchester, Liverpool and beyond.

Figure 5.2 shows the area in which all three stations were subsequently built, six years before construction began on the London to Birmingham line. In 1827, the land east of Regent's Park and north of the Euston Road (then known as the Islington Road, or the New Road to Islington) was partially developed. While Bloomsbury to the south was substantially complete, building having first begun in the 1660s, Somers Town had been laid out only 30 years earlier. There was still open land between the planned grids of Somers Town and Camden Town, which was shortly to be occupied by north London's first railways.

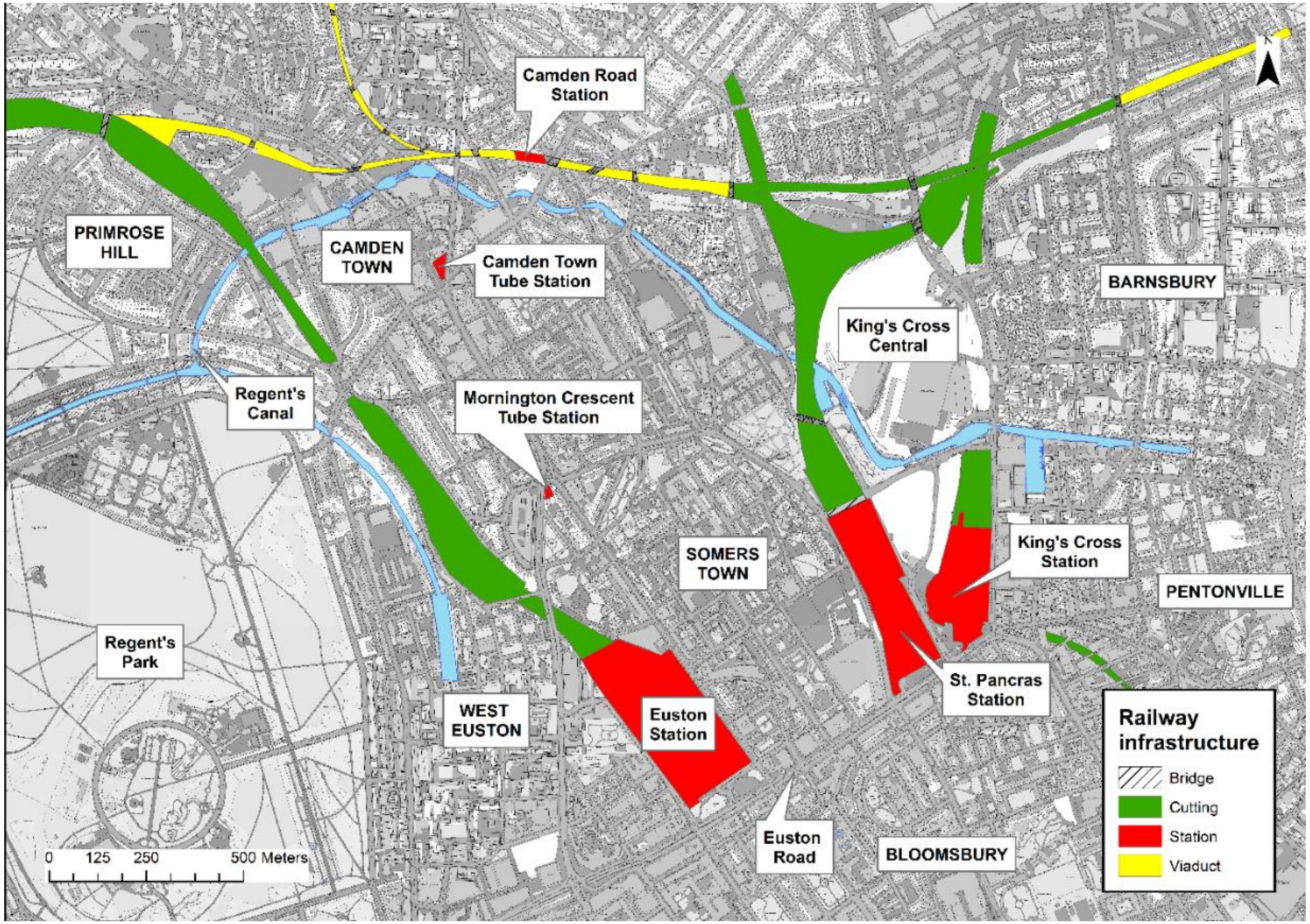

Figure 5.1: Euston, King’s Cross, St. Pancras Stations and infrastructure, 2010s.

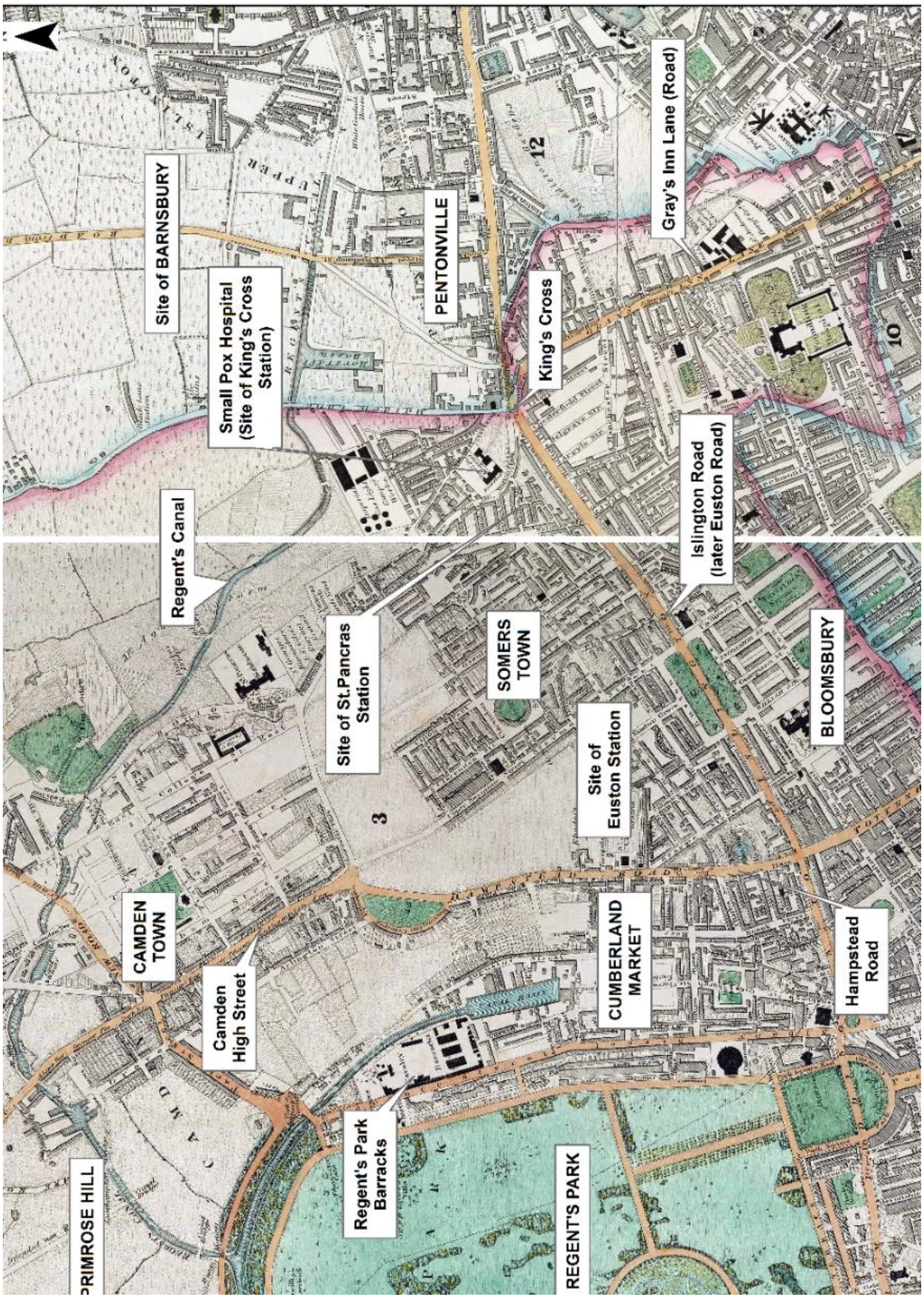

Figure 5.2: Euston, King's Cross, St. Pancras area, Greenwood Map 1827.[35]

[35] The white line across the map shows information missing at the edges of adjoining sheets.

Various sites were proposed and rejected for the London and Birmingham terminus, including at Marble Arch and at Maiden Lane, where the King's Cross Goods Yards would later be built. Eventually, the company decided to terminate the line at Camden. However, it soon realised that a station closer to the centre of London was needed, and approved an extension south. This involved raising the line over the Regent's Canal, creating a problematic gradient, so until the 1840s trains were uncoupled at Camden and hauled up the incline into Euston by fixed engines.

The station at Euston, designed by Philip Hardwick, was built with a classical grandeur intended to reflect the significance and permanence of the new railway. It occupied land belonging to Rhodes Farm, the last undeveloped area between Camden Town and Somers Town. London had already expanded north of the Euston Road to Drummond Street, and the classical façade and entrance portico of Euston Station were therefore set two blocks back from the Euston Road.

King's Cross opened in 1852, the new terminus of the Great Northern Railway with trains running direct to York. It was the largest station in the country, built on the eastern side of Somers Town in an area previously infamous for its giant dust heaps, where industrial waste had been dumped. The station required the demolition of a smallpox hospital and a number of houses on Edmond, Norfolk, and Suffolk Streets. Before the station was finished, a temporary terminus operated to the north on Maiden Lane to handle the large numbers travelling to the 1851 Great Exhibition. Complex structures were required to bring the railway line in. The station approaches pass under the Regent's Canal in a tunnel that emerges again behind the station at York Way. Here they are crossed by the North London Line on a viaduct and then enter another tunnel under Brewery Road, before surfacing again to traverse north London in a cutting. Since the station was built the complexity of the infrastructure behind the station has increased, and the King's Cross approaches are now also joined by separate lines from St. Pancras and crossed by the High Speed One line, all within a 400m stretch.

St. Pancras Station was the last of the three terminals to be built. It was not until 1866 that the Midland Railway Company was able to buy land north of the Euston Road from Lord Somers, on whose land Somers Town had been built. The Midland ran goods trains into London but was forced to pay to use the Great Northern mainline. In 1864 the Company had opened a new goods yard, immediately to the west of the Great Northern Goods Yard, and was keen to take control of its own lines and compete for passenger traffic. By the 1860s the task of bring in new railway lines and clearing space for a passenger terminus was even more complex. The entirety of Agar Town, widely if unfairly condemned as a slum (Bolton, 2013), was demolished along with several blocks of east Somers Town. A brand new church, St. Luke's, Somers Town, and a partially completed one, St. Thomas's, Agar Town, were knocked down, and the railway company obliged to pay for replacements elsewhere. It was not, however, obliged to compensate the estimated 10,000 people (Jackson, 1969) whose homes were demolished.

The railway was brought over the Regent's Canal on a bridge, with the result that the platforms at St. Pancras were positioned at first floor level. This left room underneath for purpose-designed beer vaults, where barrels from Burton-on-Trent were stored, now converted to circulation and shopping space.

A complex picture of expansion and contraction is apparent over the 180 years since Euston Station opened, shown in Figure 5.3. It shows the area occupied by the railways in the past, and that proposed for railway use in the future. All three stations have expanded several times since their construction, and during the twenty-first century this area of London has seen more development than any other terminus area.

Hardwick's 1837 Euston Station building survived, patched with additions and expansions, until it was demolished in 1961 amid London's most celebrated conservation furore. An entirely new station was completed in 1969, occupying a larger footprint and including an extended forecourt area with office blocks. The old station building had been expanded to the west between 1887 and 1892, cutting off the corner of the St. James's, Westminster burial ground. The original two platforms had expanded to fifteen by 1961, and the station approaches doubled in width, occupying the area behind the station that had previously been Ampthill Square, and widening the lines to Camden at the expense of houses on the west side of the cutting.

King's Cross operated for 25 years with only one departure platform for all mainline, local and, eventually, Underground trains. However, expansion eventually began in 1875, when a local station and train yard were built to the west. This was the start of a process that saw the railway take over surrounding streets. By the twenty-first century two buildings remained of the streets between King's Cross and St. Pancras that pre-dated the stations.

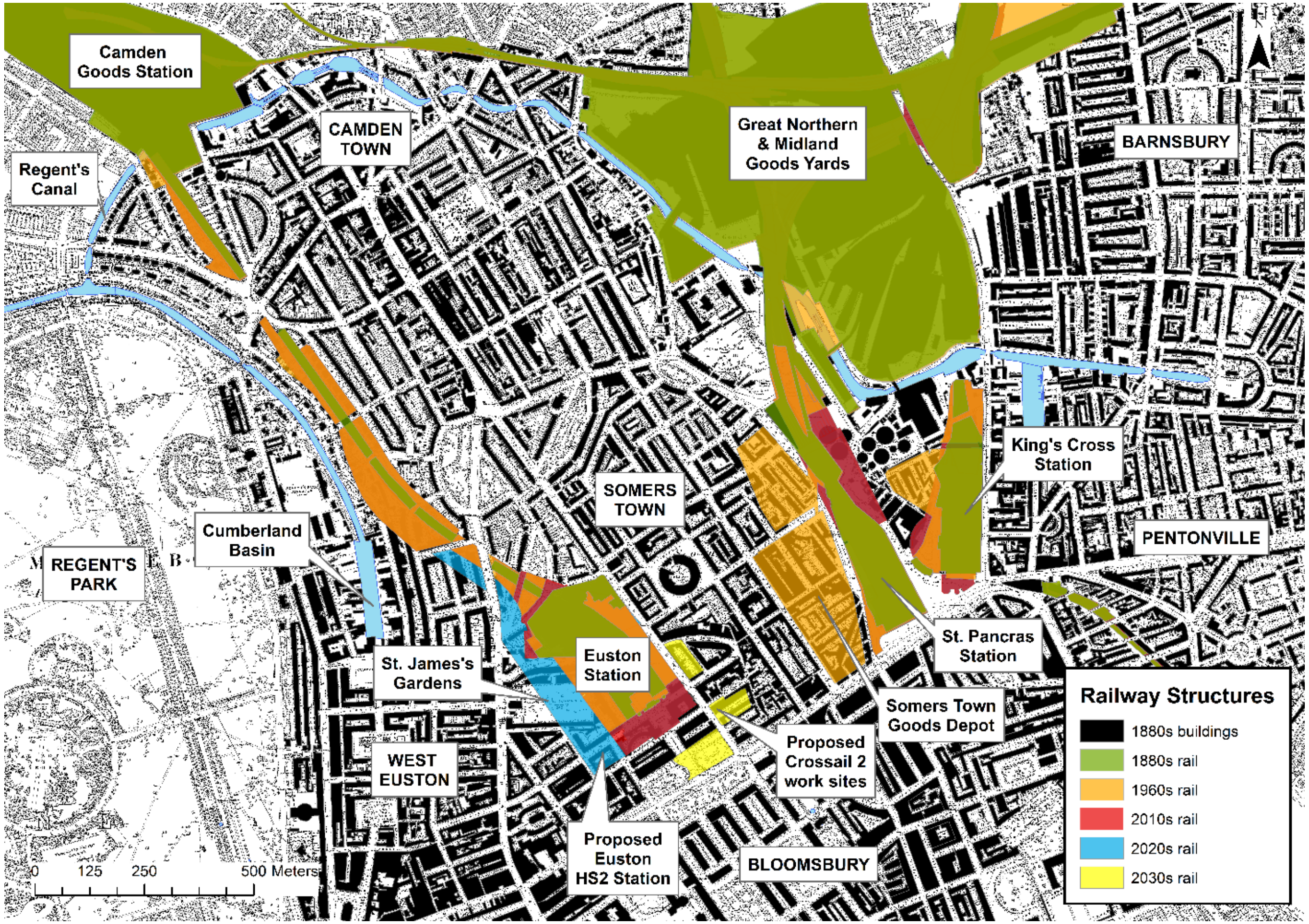

Figure 5.3: Euston, King’s Cross, St. Pancras Stations expansion 1880s-2010s.

Passenger numbers increased rapidly from the 1860s and, over the next two decades, three further tunnels and a bridge were built to cross the canal. The Great Northern Railway had taken possession of more than 30 hectares of land north of the canal, which became the Goods Yards, with canal docks and basins for transferring goods by water, warehouses holding goods from beer to grain and potatoes, and drops and shoots where coal was stored for the engines. These structures were on a large scale with, for example, the coal shoots lined up along 150 metres of Cambridge Street (now Camley Street).

The incursions of the Midland Railway into Somers Town did not end with the completion of St. Pancras Station. In 1887 the Somers Town Goods Depot and Potato Market opened to the west of the station, a development that required the demolition of a further fifteen Somers Town streets.

The Somers Town Goods Depot closed in the 1970s, and after a period of dereliction part of the site became occupied by the British Library and, more recently, the remainder by the Francis Crick Institute. This was part of a process of widespread deindustrialisation that has seen the amount of land in the area occupied by the railway shrink dramatically from a peak of 1,135,386m^2 in the 1960s, in the area shown in Figure 5.3. The total area of railway land increased from 914,110m^2 during the 1880s, and by the 2010s had shrunk to 461,383 m^2, less than half the 1960s figure.

This change reflected the redevelopment of the goods yards. The Midland Goods Yard was partly redeveloped for housing in the 1980s, the Elm Village estate occupying the site of the demolished Agar Town. Camden Goods Yards (outside the study area) closed in the 1970s, with housing and a supermarket were built on the site in the 1990s. The Great Northern Goods Yard development finally got underway during the 2010s, after two decades of failed proposals. The area developed as King's Cross Central is large enough to require its own postcode (N1C).

However, despite the release of former goods land and the development of large areas, the railways still dominate the neighbourhoods behind the three stations, and are expanding again. The construction of the High Speed One Channel Tunnel link to St. Pancras, which opened in 2007, required the demolition of the remaining Victorian streets between King's Cross and St. Pancras Stations, the extension of St. Pancras Station to twice its previous length, the re-routing of roads and the removal of listed gas holders. A section of Old St. Pancras Churchyard was also taken for the railway.

More recently, advanced proposals for a High Speed Two (HS2) rail link to Birmingham involve a new terminus adjoining the west side of Euston Station. This will require the demolition of several streets currently occupied by houses, shops, pubs, businesses and a school. The remainder of St. James's Gardens, now a local park, will also be removed and the station approaches widened, demolishing blocks at the north-east corner of the Regent's Park Estate. HS2 also currently requires the Hampstead Road to be elevated by four metres.

In 2016 plans were published for a Crossrail 2 Underground line, linking north-east and south-west London, including worksites on Euston Square Gardens and in Somers Town to the east of the station, and requiring the demolition of a pub and a block of nineteenth century shops and houses. This scheme continues a process of expansion into surrounding streets that has taken place at regular intervals since the arrival of the railways.

Euston, King's Cross and St. Pancras Neighbourhoods

All three stations are mapped, as they were in 2014, in Figure 5.4. The frontage of Euston Station, facing Euston Road, has a complex layout which acts as a confusing entrance point to the city. Travellers exit the station via main doors at the front of the station, orientated towards Euston Road and Bloomsbury. However, to leave the station grounds they have to negotiate the Plaza in between, which has several semi-hidden exits, a bus station fenced to separate pedestrians from traffic, and Euston Square Gardens, also fenced. However, despite this difficult interface with surrounding streets all but one of the station's exits are in its front, south-eastern wall, so passengers leaving the station are almost exclusively directed to Euston Road. The single side-exit, on the western side of the station is difficult to find from inside the station and used by fewer passengers. The station has no rear exits and there are no crossing points over the railway for 750m behind the station exits. The west side of the station consists of 250m stretch of blank wall on Cardington Street (Figure 5.5), and the east side is a 375m wall along Eversholt Street, broken only by service gates. The nearest crossing point over the railway lines behind the station is the bridge at Hampstead Road, a 750m walk from the main station exits.

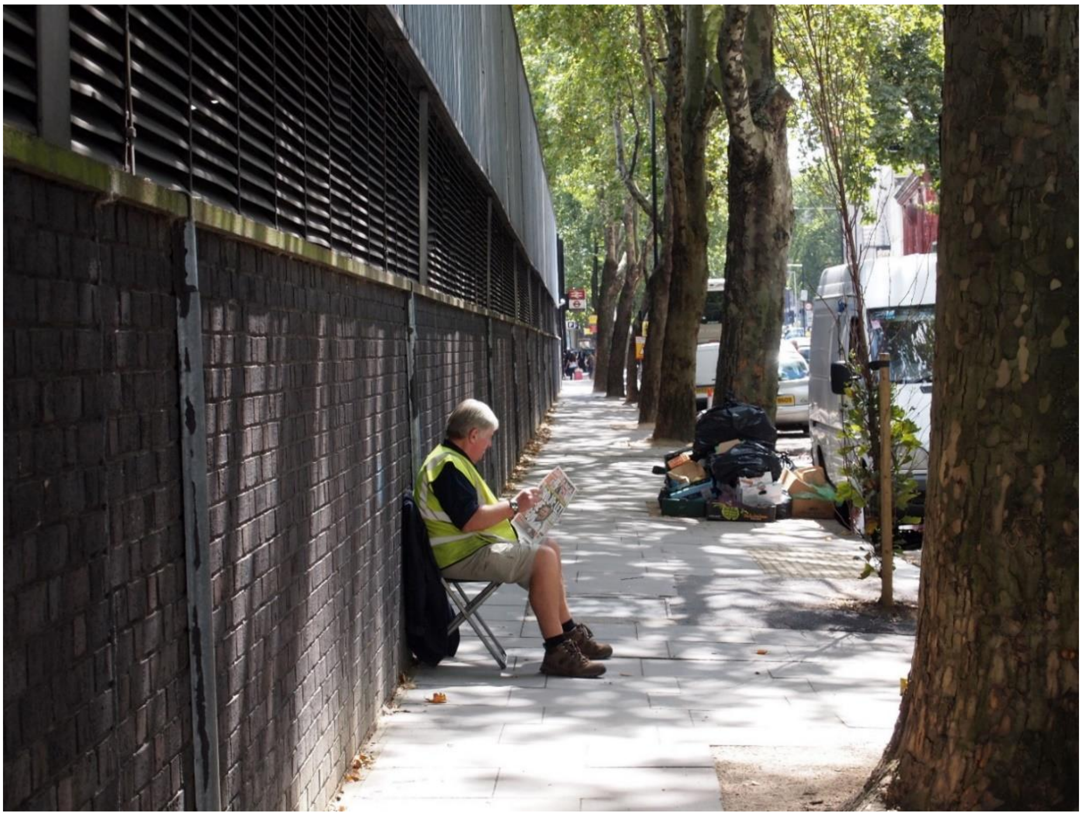

Image 5.1: Euston Station blank wall, Cardington Street.

Originally both King's Cross and St. Pancras stations also had entrances and exits only at the front, leading directly on to the Euston Road, but they were redesigned during the 2000s to create additional side entrances facing each other. This has effectively merged the stations, with passengers passing directly from one to the other. St. Pancras also acquired new exits on its western side, facing the Crick Institute and the British Library, but King's Cross Station has no exits on its eastern side, where the station wall presents an imposing, impenetrable 250m façade. The King's Cross Central development has opened up the former Goods Yard area to the north of the station, drawing pedestrians into an area which was previously inaccessible. However, adjacent areas behind King's Cross are not as easy to access. Somers Town is separated from King's Cross Central by a pedestrian-unfriendly road tunnel, and the busy York Way forms the eastern site boundary, an edge reinforced by perimeter blocks that are the tallest in the development.

Movement to and from all three stations is therefore guided towards the south and south-east and central London via the stations' exits. While areas south of the Euston Road are directly accessible, along with King's Cross Central and institutions on the former Somers Town Goods Yard site, the areas behind all three stations are far less easy to access.

Figure 5.5 shows the boundaries of the neighbourhoods surrounding Euston, King's Cross and St. Pancras stations as defined for analysis, with all the street segments that they contain. Defining distinct neighbourhoods, with clear identities and boundaries, is straightforward in front of the station. Here Bloomsbury covers the area bounded by Euston Road to the north, Cleveland Street–Newman Street to the west, Oxford Street–Great Russell Street to the south, and a Way to the east. To the east, the area most commonly described as King's Cross is bounded by Euston Road–Pentonville Road to the north, Southampton Way to the west, Guilford Street–Calthorpe Street–Margery Street to the south and Amwell Street to the east. The boundaries for both these areas match the London Borough of Camden wards of the same names.

Behind the stations, the picture is much more fragmented. The clear dividing line between areas in front of the three stations and those behind is the multi-lane Euston Road (which becomes Pentonville Road to the east). From King's Cross Station the route (A501 – see also Chapter Seven – Waterloo Station) widens into a trunk road with underpasses for both traffic and pedestrians, becoming the elevated Westway (A40) and eventually the M40 to Birmingham. It therefore forms a substantial barrier, wider than most central London routes. Many of the other area boundaries are formed by railway lines and by the canal, creating islands surrounded by infrastructure, more fragmented than those in front of the station.

West of Euston Station, sandwiched between the station and Regent's Park, is the neighbourhood known as West Euston. Between Euston and St. Pancras is Somers Town, separated from the Mornington Crescent area to the north by Hampstead Road–Crowndale Road–Pancras Road. Mornington Crescent is bounded to the west by the railway cutting, to the north by Delancey Street–Pratt Street, and to the east by Royal College Street.

Behind King's Cross, areas become increasingly fragmented and separated from each other, with very small yet self-contained neighbourhoods with distinct identities. The area between Royal College Street, the Regent's Canal and the approaches to St. Pancras Station is Old St. Pancras, the location of the hamlet that pre-dates all subsequent development in the area. North of the railway lines are the Maiden Lane and Agar Grove Estates, built on former railway sidings south of Agar Grove, substantially self-contained areas through their design.

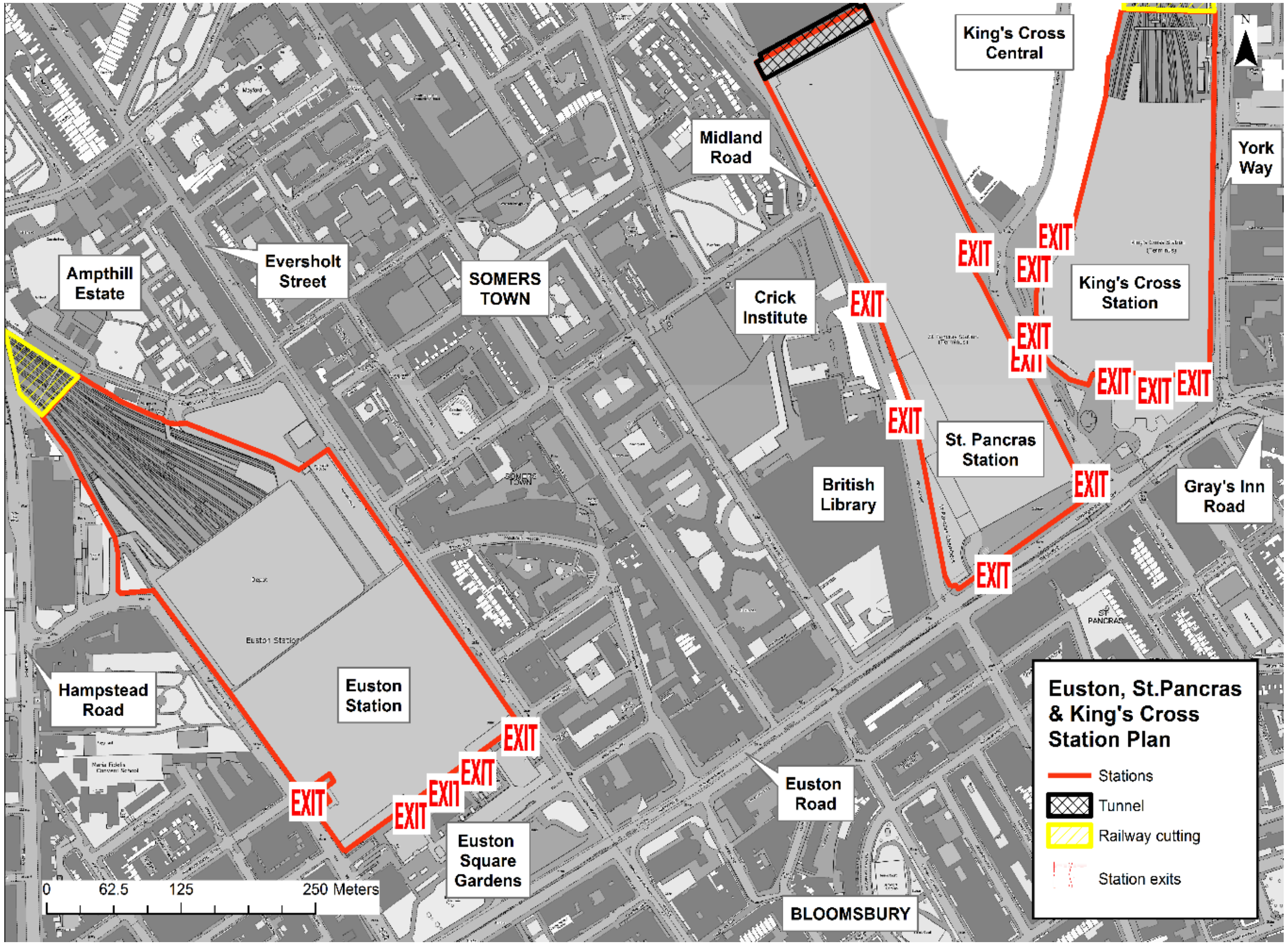

Figure 5.4: Euston, King's Cross, St. Pancras station plans 2014.

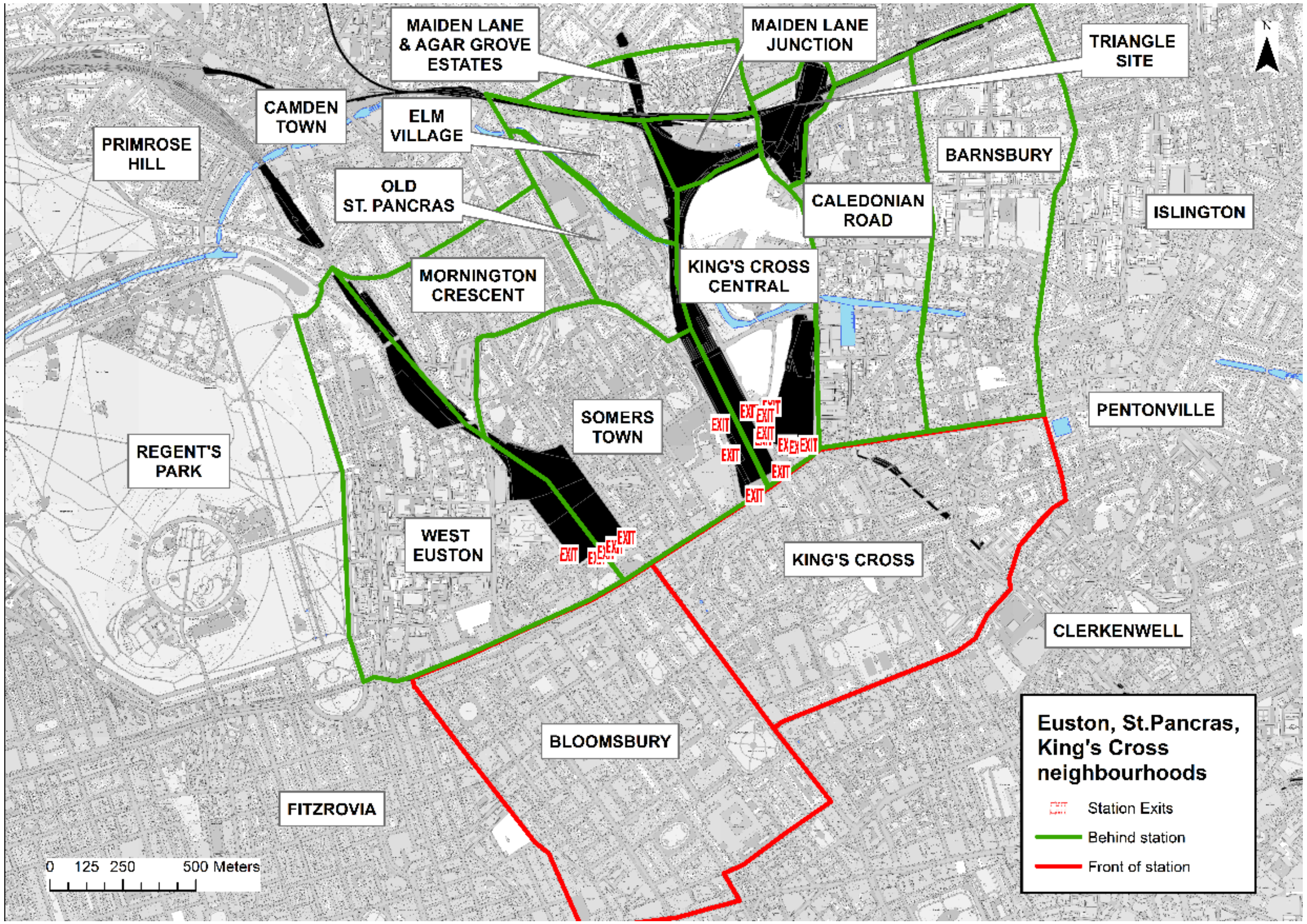

Figure 5.5: Euston, King’s Cross, St. Pancras neighbourhood boundaries, 2010s.

Image 5.2: Railway bridge at Camden Road, behind St. Pancras Station.

The railway lands include two further areas, Maiden Lane Junction and the Triangle Site, which do not form part of any of the surrounding neighbourhoods, being surrounded by railway lines and not publicly accessible. There is even a subsidiary island area within the Maiden Lane Junction, surrounded by another set of railway lines and occupied by a cement works, with a single access road.

East of King’s Cross Station, the Caledonian Road neighbourhood lies between railway lines to the west and the north, Caledonian Road to the east and Pentonville Road to the south. Barnsbury is bounded to the east by Penton Road–Barnsbury Road–Thornhill Road. The former Goods Yards area behind King’s Cross, still under development, has emerged as a separate neighbourhood in its own right, and has adopted a name previously applied to the streets south of the station.

Block sizes for Euston, King’s Cross and St. Pancras are mapped for both the 1880s and 2010s in Figures 5.6. and 5.7. Station buildings and railway lines are shown divided into separate blocks where a road passes above or below them, to illustrate the extent to which they act as physical barriers to movement.

In the 1880s, the largest blocks in the area by far were formed by stations and railway lines, with Figure 5.6 dominated by the vast, combined Midland and Great Northern Goods Yards site (373,559 m^2). Although the overall area used by the railways had reduced greatly by the 2010s, these areas are still large enough to dominate. As Figure 5.7 shows, Euston Station itself (95,850 m^2) has increased in size since the 1880s, and all the blocks larger than 40,000m^2 remain railway-related: Euston, King's Cross and St. Pancras Stations, the Maiden Lane Junction, the Triangle Site, and the Euston approaches. The railway embankments and land enclosed by the Maiden Lane Junction still form the single largest block in the entire neighbourhood at 106,750m^2 and the Triangle Site, which combines embankments, work sites and the High Speed One tunnel mouth, is the third largest block at 80,097m^2. The largest non-railway block on the map at only 35,853 m^2, is the British Museum.

These railway structures form substantial boundaries, which define and separate neighbourhoods. Although the railway lines behind Euston Station are sunk in a cutting they are bridged only in three places between the station and Camden Town, creating a structure that separates West Euston from areas to the north and east. West Euston is also enclosed by Regent's Park along its western side, limiting east-west routes, and the sealed Regent's Park Barracks to the north.

Image 5.3: Hampstead Road bridge, looking south towards Euston Station.

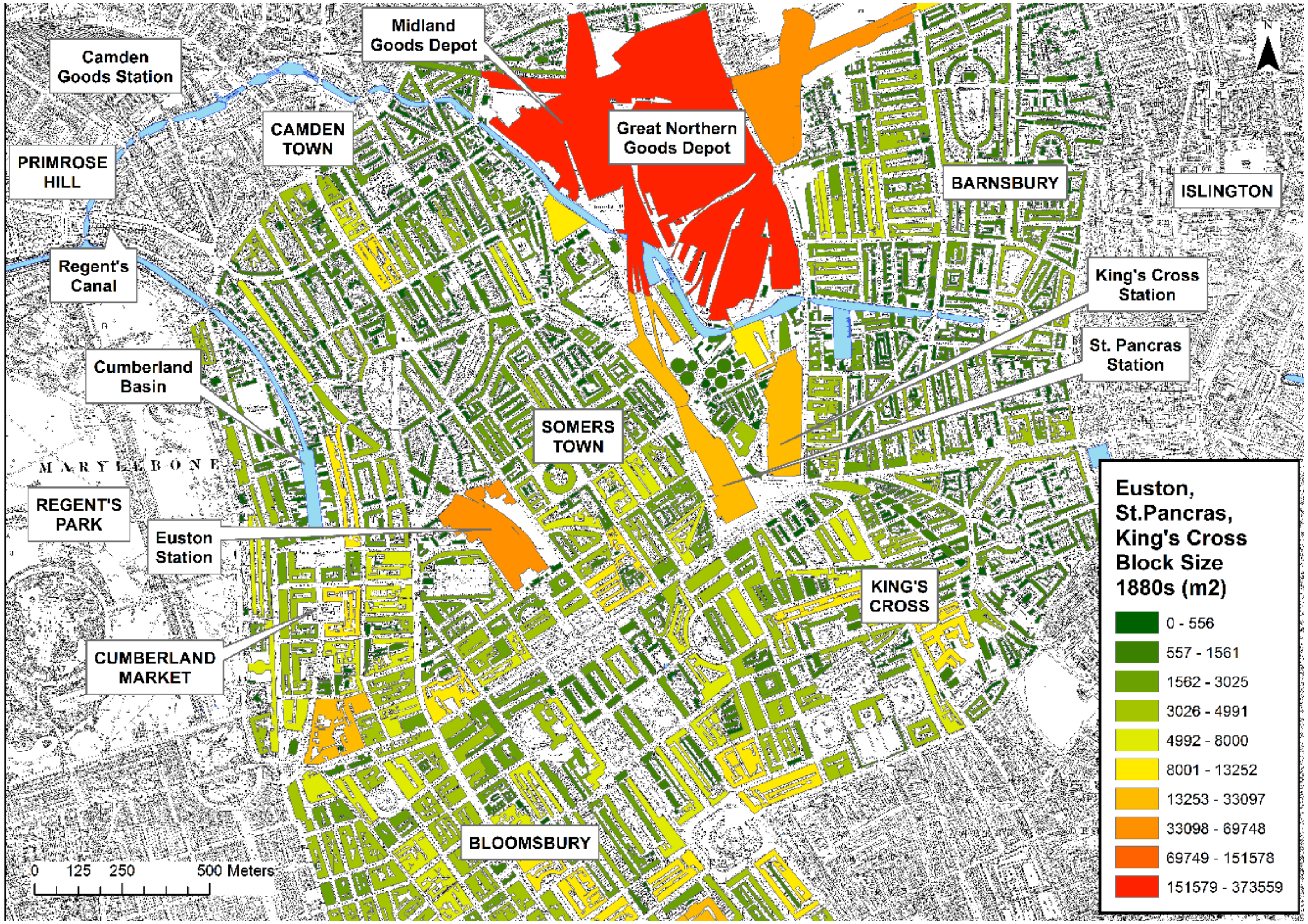

Figure 5.6: Euston, King’s Cross, St. Pancras block size, 1880s.

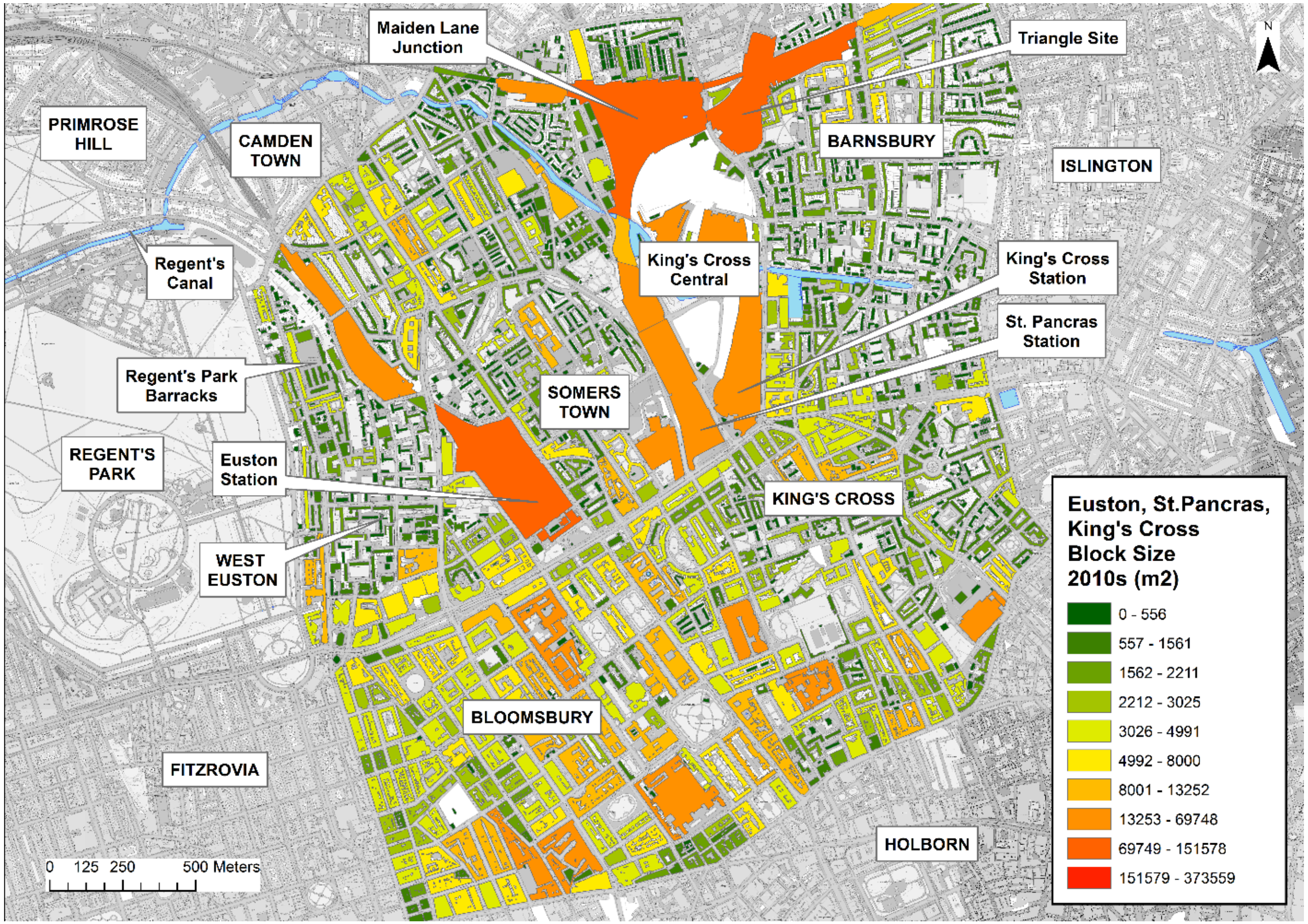

Figure 5.7: Euston, King’s Cross, St. Pancras block size, 2014.

The approaches to Euston and to St. Pancras stations surround Somers Town on three sides. The former acts like a moat, sunk in a cutting below street level, and the latter like a wall, raised on an embankment. Only a few routes cross the railway lines. To the south of both neighbourhoods, Euston Road is a six-lane arterial road with limited crossing points for pedestrians or for cars.

Figures 5.6 and 5.7 show how the urban grain in neighbourhoods around the stations has changed over time. There are clear differences in the nature of the change seen either side of the stations. In Bloomsbury and King's Cross the street pattern has remained largely unchanged since the 1880s, and the orthogonal grid on which the neighbourhood was laid out is still clearly recognisable. Much of the early nineteenth century building stock also remains, and where Georgian buildings have been demolished they have been replaced by new blocks which often have greater plot coverage than their predecessors, but which still fit within the pre-existing grid. Immediately south of King's Cross Station there are small areas of post-war reconstruction, where terraces were replaced with modernist estates, but these also have been largely incorporated into the nineteenth century street pattern.

There has also been change along the Euston Road, with larger blocks such as the 2000s Regent's Place development, set back from the newly-widened road. Blocks facing on to Euston Road on both sides are uniformly large, mostly commercial headquarters buildings, institutions and hotels.

In contrast, neighbourhoods behind the stations have a predominance of housing originally built by the London Borough of Camden and other social housing providers. Barnsbury/Caledonian Road, Somers Town and West Euston have been reshaped by several waves of demolition and rebuilding, which began in the early 1900s and have left little of the original Regency, Georgian and Victorian building stock behind. Apart from the narrow band of John Nash terraces and mews facing Regent's Park on the edge of West Euston, the only areas that retain both pre-twentieth century street pattern and plot sizes are a set of six streets around Drummond Street, to the south west of Euston Station, and the residential Charrington Street Conservation Area in the north-west corner of Somers Town (preserved from demolition in the 1970s by protest and squatting).

Barnsbury/Caledonian Road, Somers Town and West Euston have become residential neighbourhoods, dominated by an extensive typology of twentieth century social housing blocks which are freestanding, unconnected to other structures, and do not address the street directly, as described in Somers Town by Hanson (2000). Somers Town was remodelled in several phases, beginning in 1906 with the early slum clearances of the pioneering St Pancras House Improvement Society. The result has been described as a “housing zoo” with “at least one specimen of just about every ‘species’ of twentieth century social housing” (Hanson, 2000, p. 103). This development process continues, with permission recently granted for the construction of further housing, although now for private sale.

West Euston, occupied by Cumberland Market during the late nineteenth century, is now the site of the large Regent’s Park Estate. The market was ultimately a failure, opening in 1830 as a replacement for the hay market which had outgrown its West End home. Despite being served by the Cumberland Arm of the Regent’s Canal, which was surrounded by wharves, the market was never popular (Baty, 2013). A meat market planned for Munster Square never opened and the hay market eventually closed in the 1920s. The areas was heavily bombed, and the canal basin back-filled with rubble from demolished houses. The neighbourhood was then almost entirely rebuilt as the Regent’s Park Estate, construction beginning in the early 1950s.

Image 5.3: Maiden Lane Estate.

Similarly, much of the Caledonian Road area, terraced housing in the 1880s and wharves south of the canal, was rebuilt after the war. While the northern half of Barnsbury retains its original houses, almost the entire remainder of the Barnsbury and Caledonian Road areas was rebuilt in stages from the 1960s and consists of stand-alone estate blocks. The Maiden Lane estate, north of the Maiden Lane Junction, was a late addition, a council estate completed in 1980 on former sidings for the Metropolitan Cattle Market.

The aggregate number of blocks in both areas has fallen since the 1880s, but by a much greater proportion behind the stations. In front, the total number of blocks fell from 542 to 492 (9 per cent fewer) between the two periods, but behind the stations it fell from 1424 to 1105 (22 per cent fewer). This reflects a thinning out of the dense, late nineteenth century morphology in Barnsbury/Caledonian Road, Somers Town and West Euston.

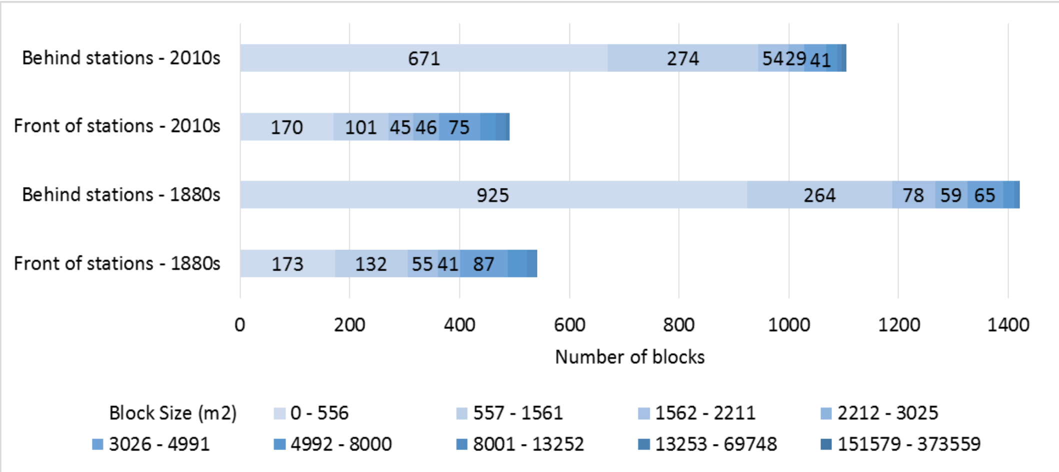

Figure 5.8: Frequency distribution of blocks by size, Euston, King's Cross, St. Pancras, 1880s and 2010s.

The distribution analysis reveals different size profiles either side of the station, a difference that has persisted. Blocks in front of the stations tend to be larger, with 26 blocks in the largest two size ranges in the 2010s, compared to ten behind the station. In both eras, neighbourhoods behind the station have a larger number of small blocks, with 252 per cent more in the three smallest size ranges in the 1880s and 216 per cent more in the 2010s.

The contrast in morphology between the front and the back of the stations is evident in the 2010s, but has become less exaggerated. The neighbourhoods behind the stations are now characterised by residential estates, and by modernist estate layouts, but block size does not tell the full story of this change. The effect on the street network is important too, as examined in the next section.

Spatial analysis

Network change

The street network for the station neighbourhoods have overlaid for the 1880s and for the 2010s in Figure 5.9 showing that, while the street pattern has remained relatively stable in front of the station, this is not the case behind.

The contrast either side of the stations shown by block size analysis is confirmed by changes to the street network. In Bloomsbury and King's Cross, street networks are almost identical between the two periods. The only substantial changes are seen where the Euston Road has been widened and an underpass added, and in the addition of Rosebery Avenue which opened in 1892.

Behind the station, the street network has changed significantly in the neighbourhoods closest to the stations. Much of the West Euston area was rebuilt on the site of the Cumberland Canal Basin and Cumberland Market, with the street network largely remodelled for the blocks of the Regent's Park Estate. Somers Town retains more of the 1880s street grid, with smaller areas redesigned for particular post-war developments. Elm Village and the Maiden Lane Estate introduced streets in areas that previously had no public access. The extent of the post-war rebuilding in Barnsbury and Caledonian Road is also apparent, with almost complete reconstruction north of the canal, resulting in areas that are more complex, with self-contained estate layouts replacing Victorian grids.

Table 5.1 analyses and compares neighbourhoods either side of the three stations. The data shows that total segment numbers have increased since the 1880s by 22 per cent in neighbourhoods in front of the stations, but by 83 per cent in areas behind. At the same time, mean segment length has decreased by a greater proportion behind the stations – 29 per cent compared with 15 per cent in front – and dead ends also form a greater proportion of the network. There are more, shorter segments, with many more junctions and more dead ends in these neighbourhoods. This confirms the contrasting nature of change either side of the stations. The proportionately greater change in areas behind the stations indicates a transformation from a nineteenth street layout into one that is much more complex, and segregated.

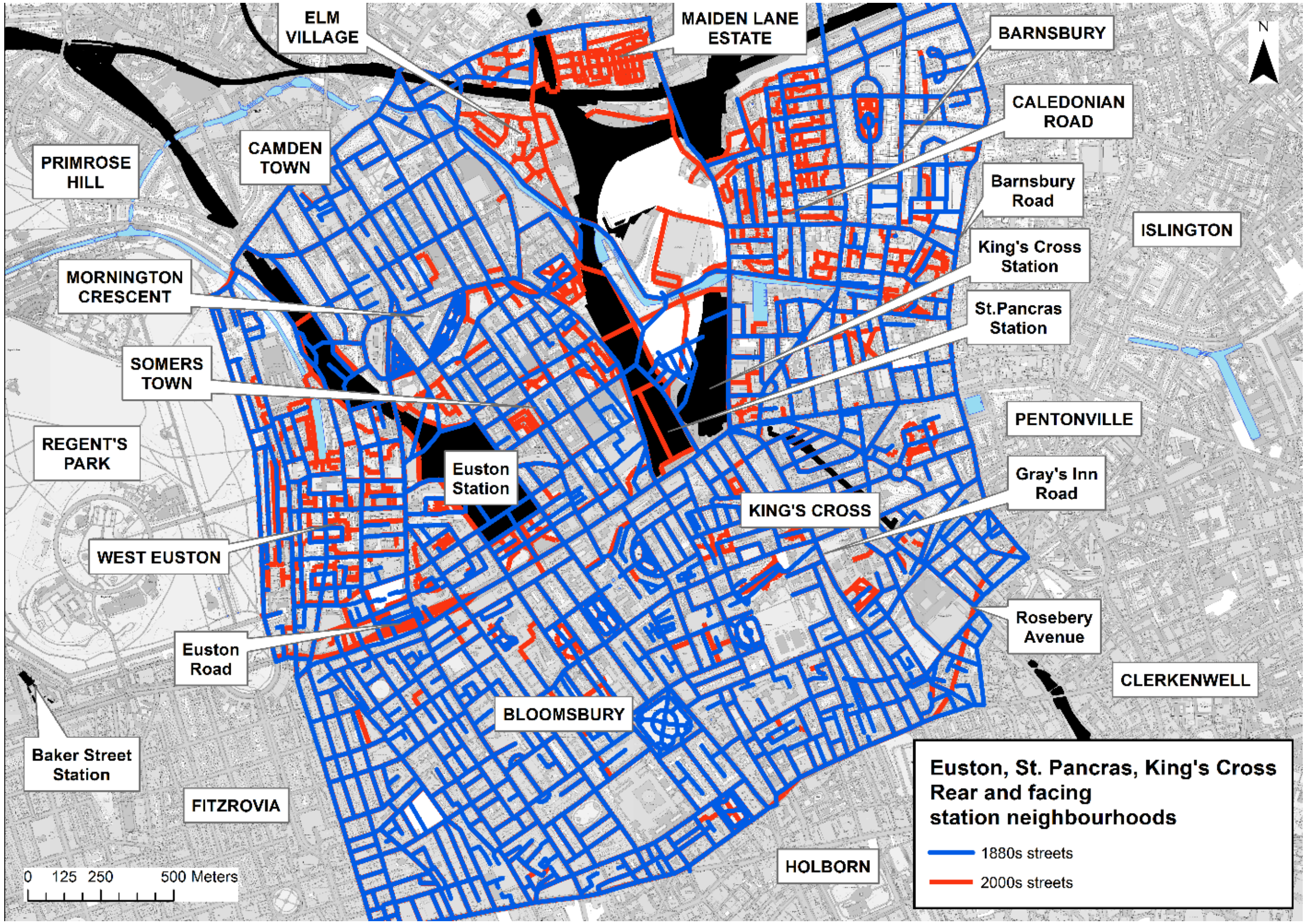

Figure 5.9: Euston, King's Cross, St. Pancras streets 1880s and 2010s.

	Total number of segments	Mean segment length (m)	Dead ends as percentage of total segments
Station front areas			
Bloomsbury / Pentonville 1880s	1187	57	1.7
Bloomsbury / Pentonville 2010s	1445	48	2.0
Percentage change	**22%**	**-15%**	**N/A**
Station back areas			
Barnsbury / Caledonian Road / Somers Town / West Euston 1880s	1241	58	1.9
Barnsbury / Caledonian Road / Somers Town / West Euston 2010s	2275	42	2.2
Percentage change	**83%**	**-29%**	**N/A**

Table 5.1: Street network data for Euston, King's Cross, St. Pancras, 1880s and 2010s.[36]

Space syntax analysis

Segment maps measure Choice at 3000m for the wider Euston, King's Cross and St. Pancras area in the 1880s and 2010s in Figures 5.10. and 5.11.

The distribution of high Choice routes at 3000m has changed little since the 1880s. In both eras, the highest Choice values are found on Euston Road, the primary east-west through-route across the northern edge of inner London, which passes the frontages of all three stations. Euston Station is within a triangle of main roads, with the main north-south route passing immediately to the east of the station along Eversholt Street, and west of the station along Marylebone Road. Other high Choice routes passing north of Euston Road are Albany Street between West Euston and Regent's Park, Midland Road, between St. Pancras Station and the British Library, and York Way, and Penton Road/Barnsbury Road east of King's Cross Station. Midland Road did not exist as a through route in the 1880s, but otherwise the same high Choice routes are found in both eras.

[36] Lower value of the two time periods shown in red, for ease of comparison.

Almost all other streets have much lower Choice values, including most of the streets of Barnsbury, Caledonian Road, Somers Town, and West Euston. Because of the large, segregated station blocks there are a limited number of east-west routes, and those that exist have lower Choice values. High Choice routes enclose the neighbourhoods behind the stations, and also surround the Drummond Street triangle to the west.

These areas contrast with Bloomsbury, where the street network forms a more complete and coherent high Choice grid, forming consistent connections across the area in both north-south and east-west directions. North-south routes such as Tottenham Court Road, Gower Street and Upper Woburn Place, and east-west routes such as Clipstone Street-Maple Street-University Street and Torrington Place-Byng Place-Gordon Square-Tavistock Place, form a grid which, unlike the streets north of Euston Road, is uninterrupted.

	Choice 3000m	Choice 800m	Choice 400m
Station front areas			
Bloomsbury / Pentonville 1880s	666009543	12833765	1560638
Bloomsbury / Pentonville 2010s	624042076	11039090	1399219
Percentage change	**-6%**	**-14%**	**-10%**
Station back areas			
Barnsbury / Caledonian Road / Somers Town / West Euston 1880s	573073634	9855469	1466863
Barnsbury / Caledonian Road / Somers Town / West Euston 2010s	386543046	8334119	1196886
Percentage change	**-33%**	**-15%**	**-18%**

Table 5.2: Mean Choice values for Euston, King's Cross, St. Pancras, 1880s and 2010s.[37]

[37] Lower value of the two time periods shown in red, for ease of comparison.

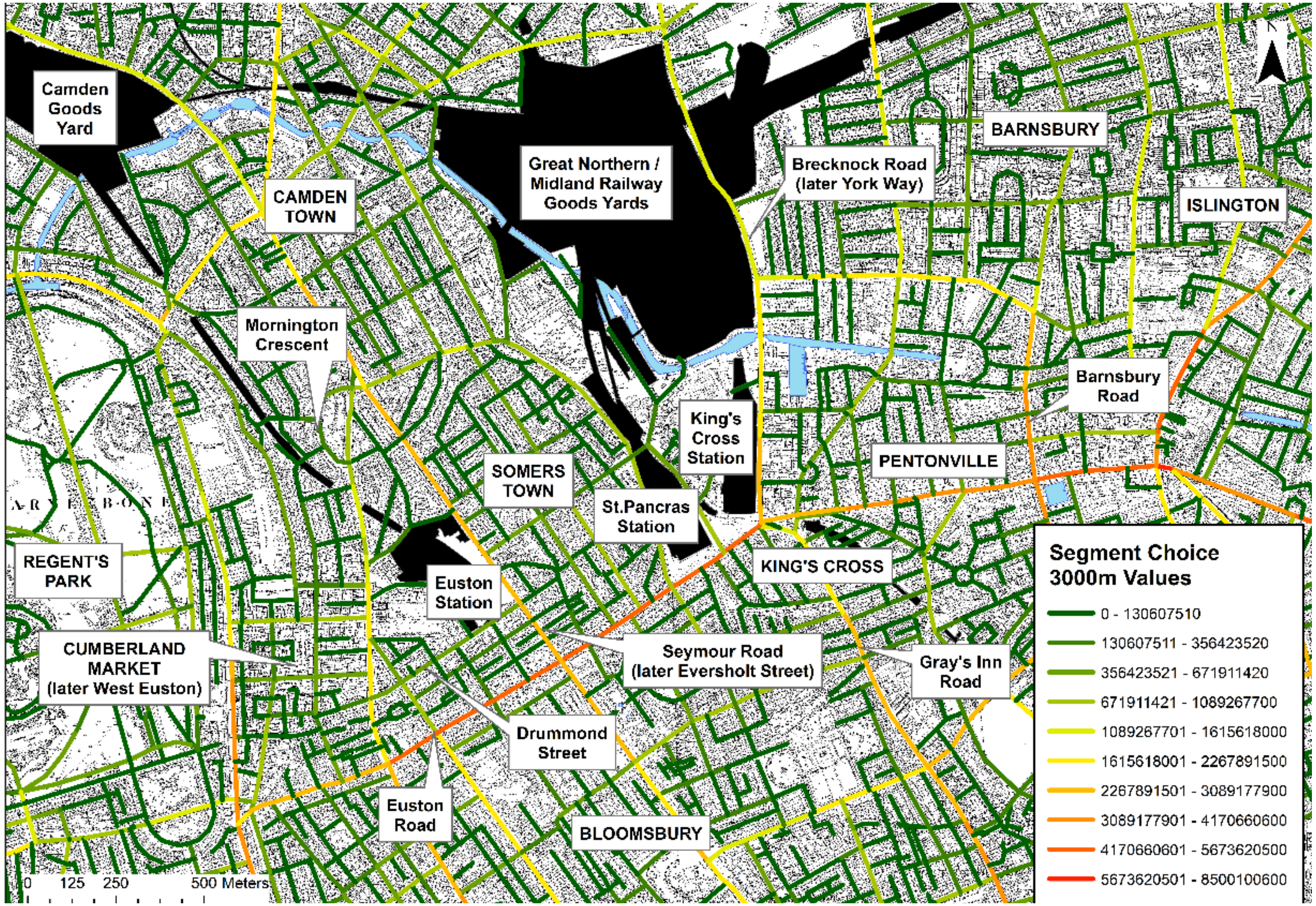

Figure 5.10: Choice 3000m Euston, King's Cross, St. Pancras 1880s.

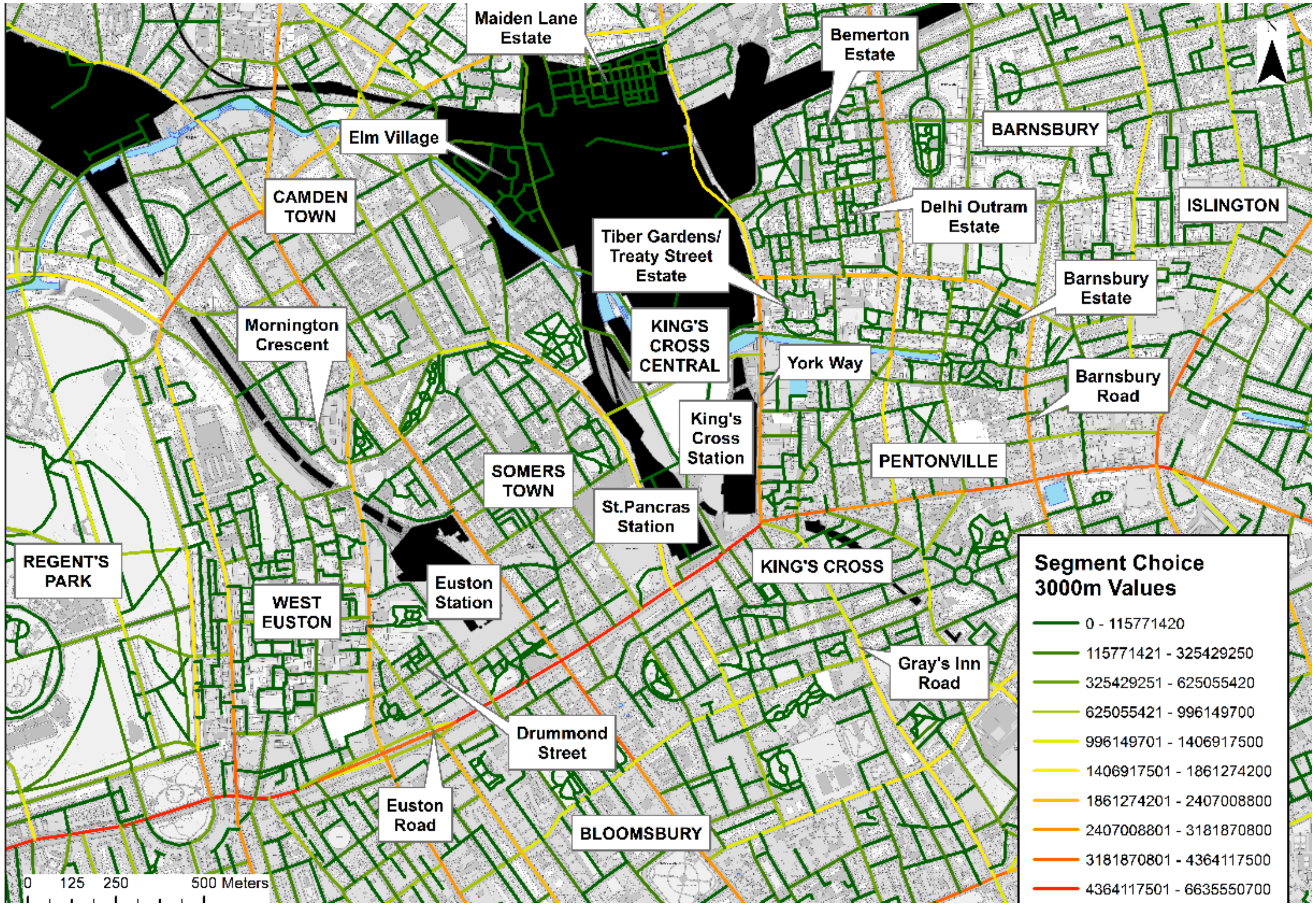

Figure 5.11: Choice 3000m Euston, King's Cross, St. Pancras 2010s.

Choice values have decreased across the scales shown above, but they have done so by a larger proportion in areas behind the stations. In particular, there is a large difference between the 6 per cent decrease in mean Choice at 3000m in front of the stations, and the 33 per cent decrease behind. This suggests different types of change taking place either side of the stations, with through routes retaining their relatively high values but other streets becoming more separate, and less likely to form part of journeys through the area. The rear of the station has become even more cut off for through journeys over time.

Local Integration, measured at 800m in Figure 5.12 highlights a "local area core grid" (Hillier *et al.*, 1993, p. 41) in the 1880s across the south of West Euston, Drummond Street and Somers Town. This grid connects in front of Euston Station, north of Euston Road. By the 2010s this grid had been partially eroded and disconnected, with the rebuilt Euston Station cutting off Drummond Street, which previously ran from West Euston to Somers Town but now ends at the station. Figure 5.13 shows Integration values fall behind the station with distance from Euston, but areas of higher local Integration remain north of Euston Road, in the south of West Euston, in the Drummond Street triangle, and in south Somers Town.

The Mornington Crescent area retains more of the 1880s grid and higher Integration values as a result, connecting to the highly integrated junction at Camden Town Underground station. Between here and the southern half of West Euston is an area of streets with particularly low Integration values, with Regent's Park to the west, and both Regent's Park Barracks and railway lines to the north. North Somers Town has a similar area of low Integration. Neighbourhoods among the railway junctions further north also have low Integration, particularly Elm Village and the Maiden Lane Estate. The latter is not only in a segregated location, but features a particularly self-contained layout of estate streets, densely connected to each other on multiple levels but with few connections beyond the estate. The Caledonian Road estates – the adjacent Bemerton, Delhi Outram, Tiber Gardens and Treaty Street Estates – form another island of low Integration where self-contained layouts with few through routes combined with locations that are separated by the canal on one side and railways on two sides.

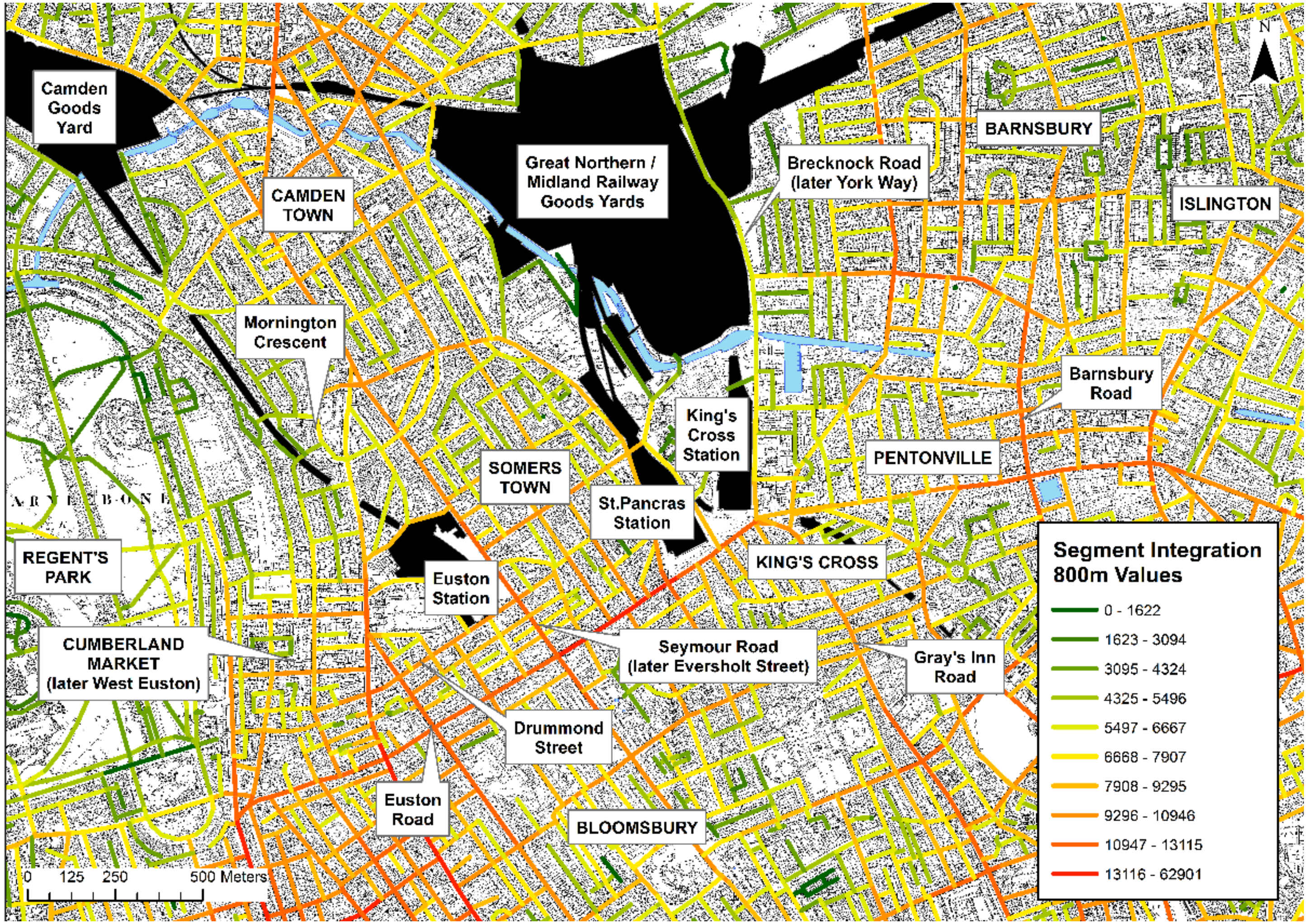

Figure 5.12: Integration 800m, Euston, King's Cross, St. Pancras 1880s.

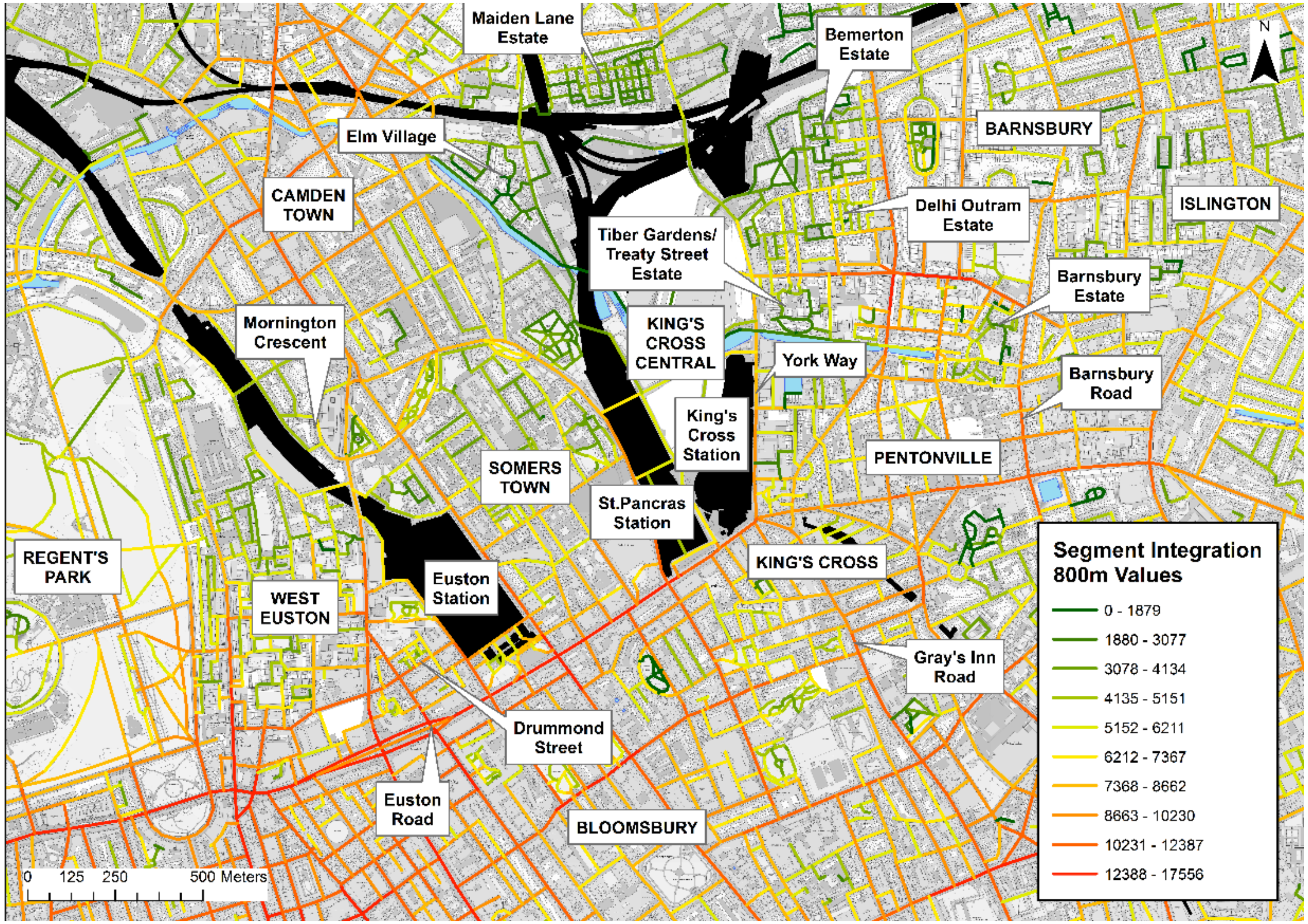

Figure 5.13: Integration 800m Euston, King’s Cross, St. Pancras 2010s.

Integration at an 800m scale reveals the qualities of the places around Euston Station most clearly. South of Euston Road, the connected grid of Bloomsbury streets and squares has consistently high Integration values. This contrasts sharply with the streets north of Euston Road, around the station, illustrating a spatial difference between central London, where the majority of streets have high potential as destinations and therefore locations for economic activity, and areas outside central London with clear separation between highly-integrated and less-integrated streets. Euston Road appears to mark a boundary between two significantly different types of place. Bloomsbury and Somers Town / West Euston have contrasting spatial characteristics, with the latter distinguished by a lack of east-west connections across the area due to the combined effects of Regent's Park to the west, and the buildings and infrastructure of Euston, King's Cross and St. Pancras Stations. Between Euston Road and Agar Grove, 1.3 miles north, no single east-west routes cross the full distance between Regent's Park and York Way, immediately east of King's Cross.

North of Euston Road, only a small number of streets have comparable Integration values to Bloomsbury. Moreover, Integration values fall away rapidly north of Euston Road and do not reach high levels again until Mornington Crescent, where Camden Town centre begins. West Euston and Somers Town, between Regent's Park, Euston and St. Pancras, are much less integrated, reflecting a lack of grid connections across these areas. The stations form physical barriers forcing movement onto a limited number of north-south corridors and limiting east-west movement, resulting low Integration 'islands'. As Hanson explained, "morphologically speaking, the area began life as a classic street system" (Hanson, 2000, pp. 101-2), but its lack of success as a middle-class neighbourhood initiated a long-term process of intervention. By the twenty-first century traces of the original street network still remain, but much less of the original building stock. The least well-integrated areas, in Somers Town and West Euston, consist almost exclusively of large free-standing estate blocks.

Behind the stations, the most integrated streets at 800m scale are those closest to the station fronts. Integration values for Drummond Street are lower than for nearby main roads, but higher than for most other streets in the area. A higher density of use in found around Drummond Street. The Drummond Street triangle contains a high proportion of nineteenth century building stock – a concentration of small buildings, contrast with the size of Euston itself and of surrounding office blocks.

The figures in Table 5.3 show that Integration values have changed little across scales in front of the stations. Behind the stations Integration has fallen more significantly, with the fall greater at smaller *scales.* These figures show how the stability of the street network in

Bloomsbury and in King's Cross has maintained Integration, while the change to street layouts behind the station has reduced local Integration by a much larger amount.

	Integration 3000m	Integration 800m	Integration 400m
Station front areas			
Bloomsbury / King's Cross 1880s	64760	8613	2876
Bloomsbury / King's Cross 2010s	67332	8319	2685
Percentage change	**4%**	**-3%**	**-7%**
Station back areas			
Barnsbury / Caledonian Road / Somers Town / West Euston 1880s	56019	7097	2668
Barnsbury / Caledonian Road / Somers Town / West Euston 2010s	53777	5956	2050
Percentage change	**-4%**	**-16%**	**-23%**

Table 5.3: Mean Integration values, Euston, King's Cross, St. Pancras, 1880s and 2010s.[38]

The neighbourhoods of Barnsbury, Caledonian Road, Somers Town and West Euston, as well as the numerous, smaller areas that surround them, are spatially separate from each other with higher Integration values restricted to the surviving sections of grid closest to Euston Road. Further north many barriers combine – bridges, embankments, cuttings, and junctions, the Regent's Canal, Regent's Park, Regent's Park Barracks – to restrict local accessibility as well as through routes. The twentieth century redevelopment of many of these areas has introduced street layouts that have accelerated the loss of Integration, leaving small neighbourhoods isolated from each other and from inner London.

[38] Lower value of the two time periods shown in red, for ease of comparison.

Land use analysis

The maps in Figures 5.14 and 5.15. below show selected land uses and segment maps with Integration 800m.

As Table 5.5 reveals, retail and industrial uses were the largest non-residential groups across the whole area surveyed. Figure 5.14 shows retail uses distributed across the mapped areas, on either side of the station. There is a particular cluster covering much of the grid of streets between Great Portland Street and Tottenham Court Road, where Bloomsbury meets Fitzrovia. Then, as now, this district was part of the West End, an area with streets of particular retail specialisms such as the furniture and household shops at the north end of Tottenham Court Road as well as a concentration of shops of all types. Bloomsbury was built as a residential estate with building types suited to doctors and solicitors, but not to shop fronts, and was originally guarded by gates so its streets were not publicly accessible. The Duke of Bedford had them erected in 1826, specifically “to shut out the low population of Somers Town” (Olsen, 1964, p. 148). It was not until 1894 that these were removed after London County Council promoted the London Building Act, which all such obstructions illegal (Atkins, 1993). As a result, there are very few shops on the central areas of the Bedford Estate’s land, and they are instead concentrated around the edges of the estate. Further clusters are founded along the main roads that converge at King’s Cross Station, including Gray’s Inn Road. A further area of few shops is created by the orphanage and open spaces of Coram’s Fields.

Behind the stations shops are concentrated along main roads such as Eversholt Street-Camden High Street and Caledonian Road, but are also distributed through the surrounding grid. This is particularly the case in the streets with higher Integration values found either side of Euston Station, in Cumberland Market, Drummond Street and south Somers Town, and east of King’s Cross Station in Pentonville and south Barnsbury. There are few shops north of Cumberland Market shops, or on the railway lands.

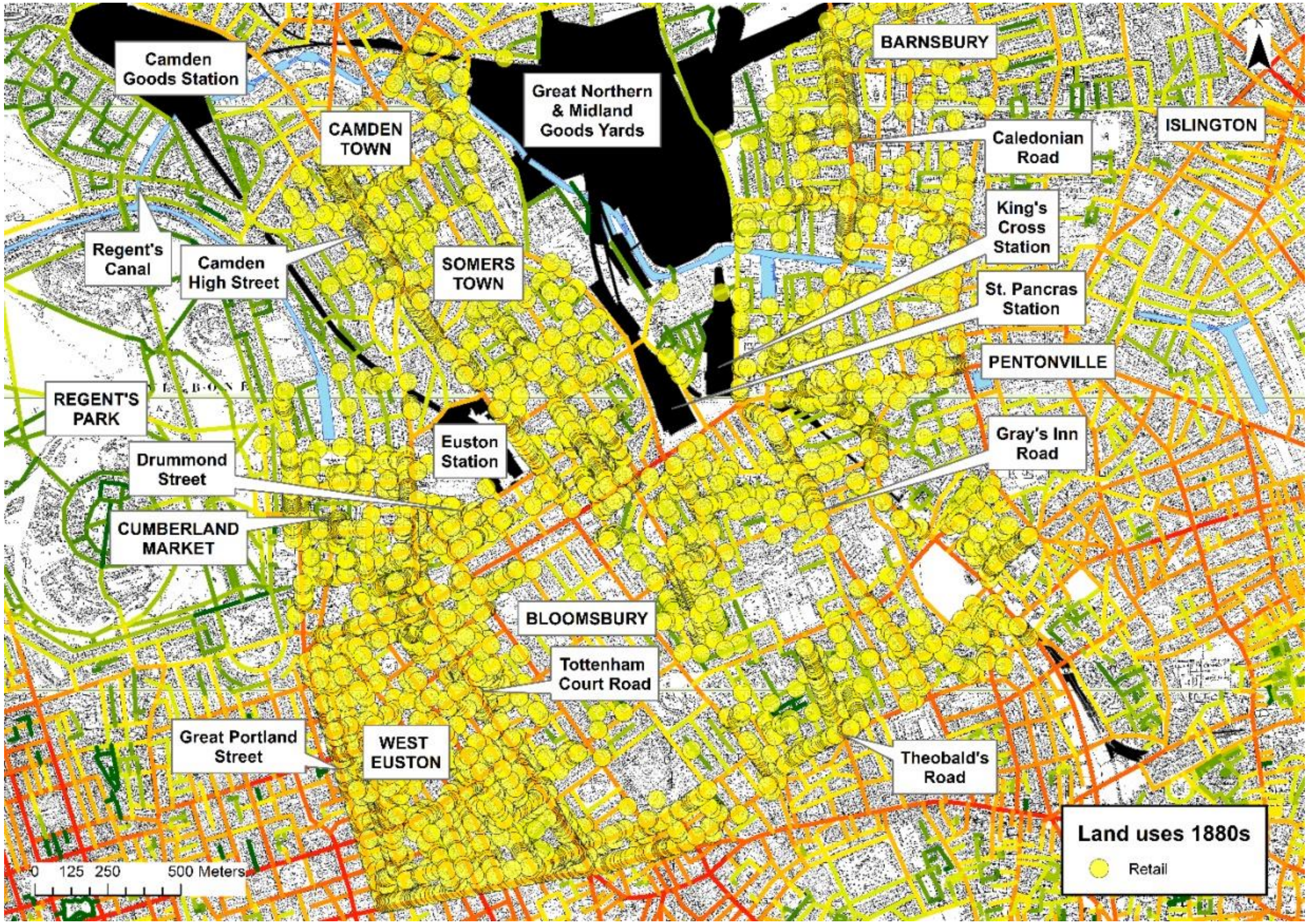

Figure 5.14: Euston, King's Cross, St. Pancras: retail 1880s, Integration 800m.

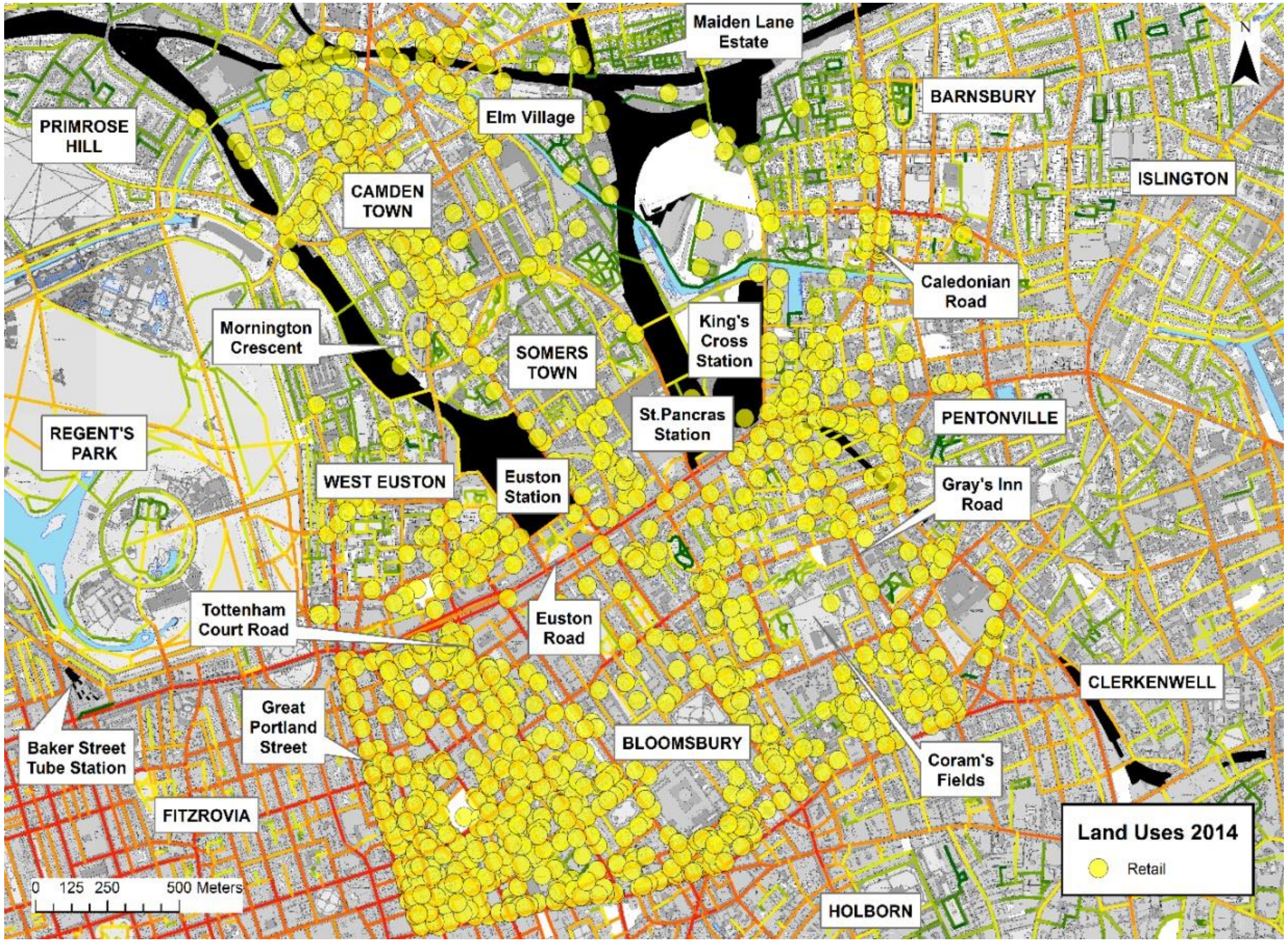

Figure 5.15: Euston, King’s Cross, St. Pancras: retail 2010s, Integration 800m.

In 2014, the pattern of distribution of retail premises in front of the stations is similar to the 1880s. The cluster between Great Portland Street and Tottenham Court Road is still in evidence, as are emptier blocks in the centre of Bloomsbury and at Coram's Fields. The grouping east of King's Cross Station, around the junction of Gray's Inn Road, King's Cross Road, Pentonville Road, Caledonian Road and York Way, is also still in evidence. In the Barnsbury and Caledonian Road neighbourhoods retail has thinned out, and is now restricted to contained sections of Caledonian Road itself, and to York Way alongside the station. In Somers Town, retail is still almost entirely absent from the northern half of the neighbourhood, and is only found on two streets in the south (Eversholt Road, along the east flank of Euston Station, and Chalton Street, the traditional market street in the area). Retail density increases further behind the station where Camden High Street begins. In West Euston, retail is now also absent from the south of the area as well, with only the remaining streets of the Victorian grid around Drummond Street.

It can been seen from Table 5.5 shows that there are fewer retail premises across the entire mapped area, with a 35 per cent reduction between the two periods. However, the fall has been greater behind the stations – 55 per cent – than in front – 26 per cent. Mean 800m Integration values for retail have risen in front of the stations, but have fallen behind. However, mean 3000m Choice values have risen for retail in both areas, by 26 per cent in front and by 30 per cent behind. Mean segment length has fallen in front of the stations, but risen behind. These changes show that, while the number of retail premises has fallen since the 1880s, areas behind the stations have been effected to more than double the extent. Those shops that remain are more likely to be found on longer segments of through routes than on streets well located for local access.

Premises that are either in the Public Houses category (including beer retailers), or the Eating category (cafés, coffee houses or restaurants) are mapped in Figures 51.6 and 5.17. They show similar patterns between the two time periods to those seen in Figures 5.14 and 5.15. During the 1880s, pubs and cafés were concentrated on main roads and in the West End, but were also distributed across neighbourhoods on both sides of the station. They are also found clustered immediately in front of and alongside the stations. The areas lacking premises in this category are, again, the Bedford Estate where they were intentionally excluded, and Coram's Fields.

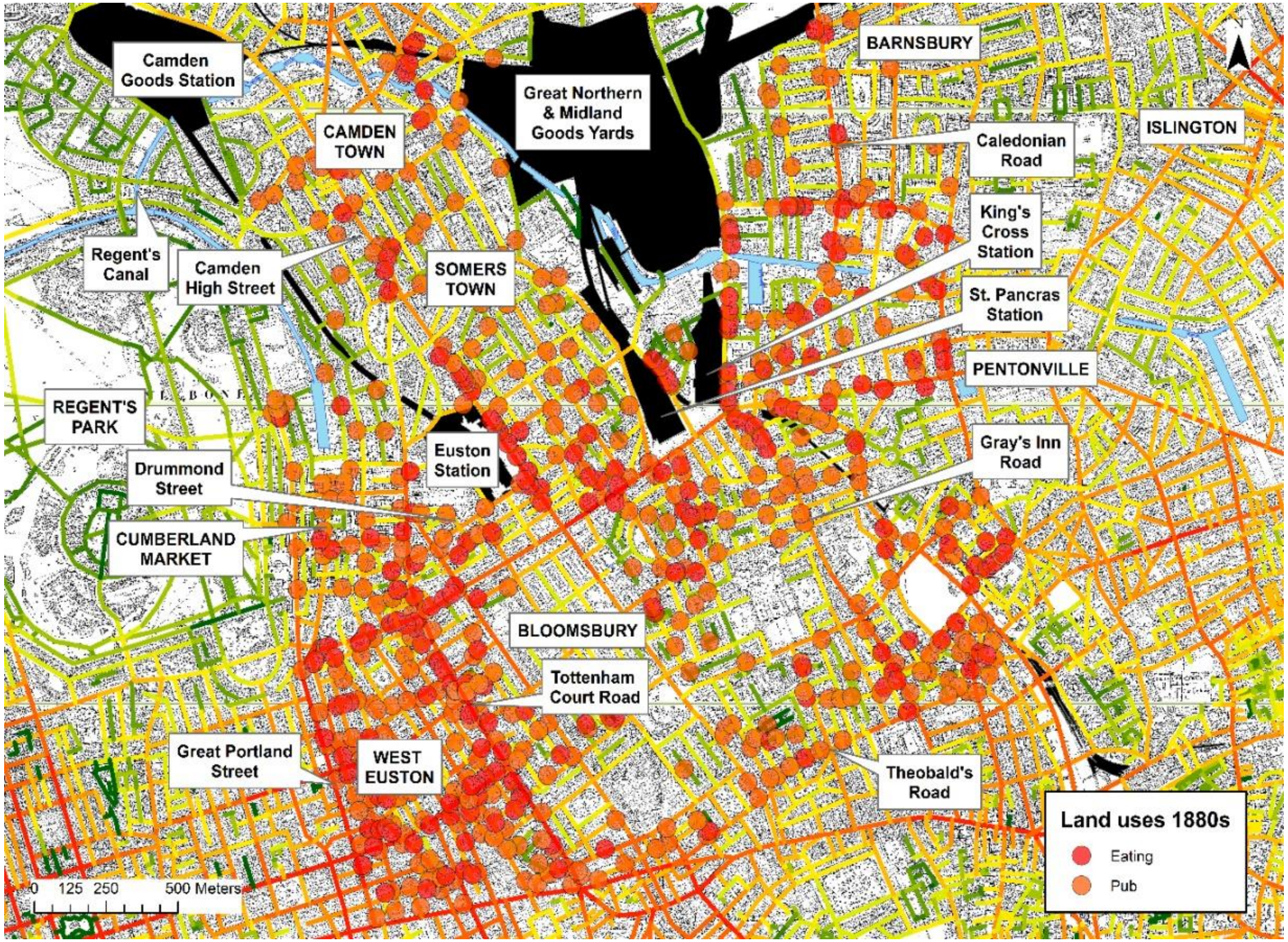

Figure 5.16: Euston, King's Cross, St. Pancras: public houses, eating 1880s, Integration 800m.

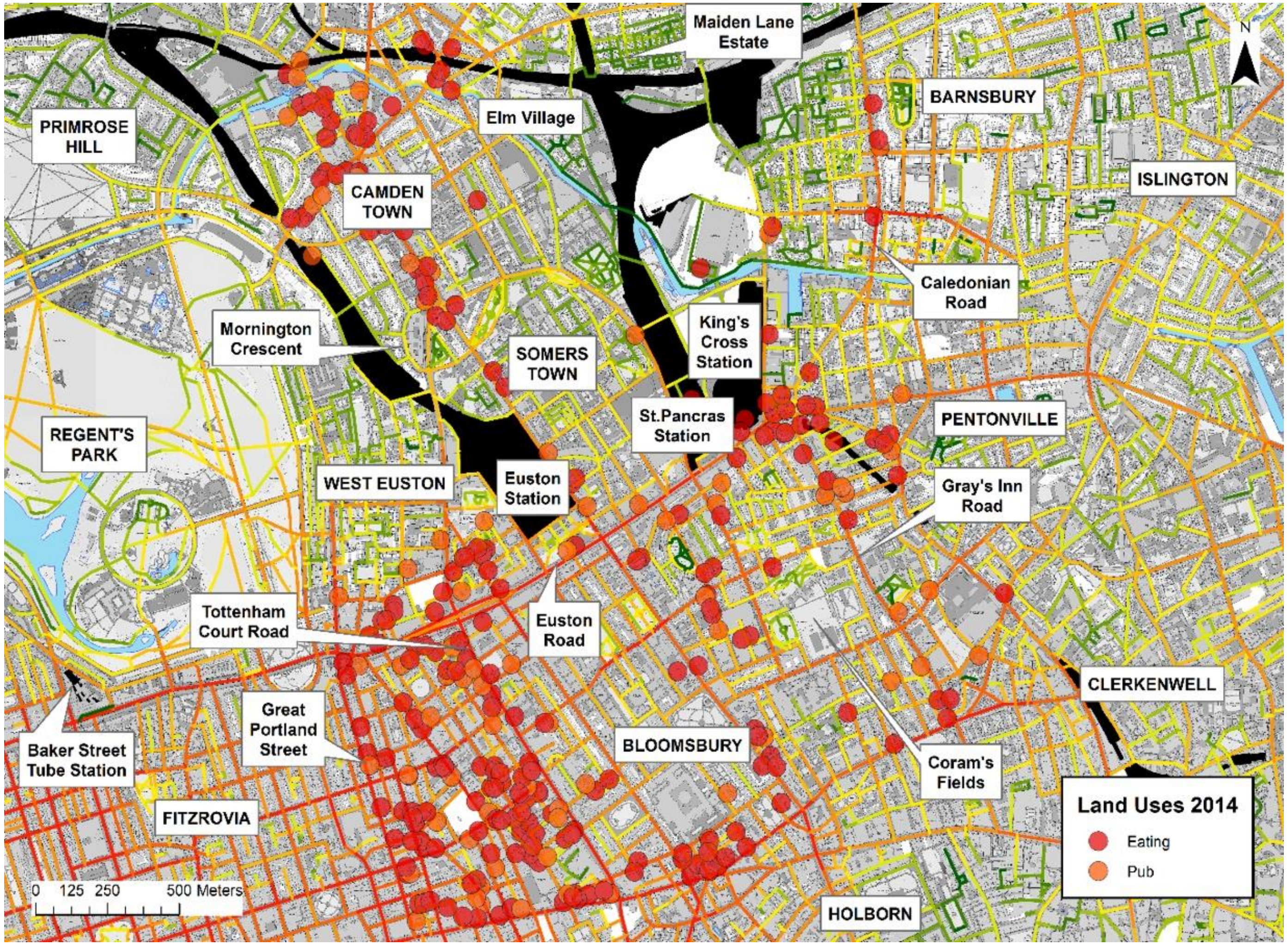

Figure 5.17: Euston, King’s Cross, St. Pancras: public houses, eating 2010s, Integration 800m.

By 2014, as shown in Figure 5.17, pubs, cafés and restaurants have disappeared almost entirely from West Euston and Somers Town, and east of King's Cross are found only in small numbers on the Caledonian Road. The overall numbers in these categories have fallen substantially since the 1880s, with far fewer pubs now than in the late nineteenth century. However, the fall has been greater behind the stations – an 85 per cent decline – than in front – a 65 per cent fall.

Behind the stations, these uses are found in a limited number of locations around Drummond Street, Eversholt Street and Chalton Street in Somers Town, and in Camden Town. The Drummond Street triangle forms a small local centre, close to both Euston Station and the junction of Euston Road and Hampstead Road, the highest Choice route between Regent's Park and the station. The Drummond Street area combines residential, commercial and retail uses, often in the same building, and within individual blocks, some of which are still penetrated by alleyways as they were in the 1880s, when many of the blocks enclosed manufacturing uses. This contrasts with the larger office blocks facing Euston Road, which tend to be single use and enclosed.

Image 5.4: Nos. 34-70, Eversholt Street.

From car hire to sex shops, the uses at Nos. 34-70, Eversholt Road (Image 5.4) alongside Euston Station, are designed to benefit from proximity to transient customers. The sex industry, traditionally linked to the passing trade supplied by stations and to availability of hotel rooms (Ashworth, White and Winchester, 1988), was a visible feature of the Euston, St. Pancras and King's Cross area until the mid-2000s. Redevelopment of these stations has removed all evidence, with the exception of this Eversholt Street block. It is therefore not surprising that the demolition of the block is included in plans for Crossrail 2, a factor in keeping rents low and occupiers unchanged. The uses further away are more locally-orientated, including cafés and hairdressers. The contrast between rows of shops and doorways on the east side of the street and the ¼ mile of blank wall opposite is extreme, concentrating traffic pollution and noise and making the street an unpleasant place for the pedestrian.

Image 5.5: Ambala, Drummond Street.

The Drummond Street area has a different identity from surrounding streets, distinctive because it contains a high proportion of South Asian shops (Image 5.5), restaurants, a sari shop and a mosque. These are supplemented by an eclectic selection of premises including African, Malaysian and Vietnamese cafés, a yoga workshop, a professional camera shop, health-food shop, the award-winning Bree Louise pub and the Camden People's Theatre. There are no chain shops. The Drummond Street area is a portion of the original street grid. As Euston Station has developed and grown, connecting streets to the east have been severed, fragmenting the surrounding grid. However, enough remains of the street network around Drummond Street to represent an integrated local centre.

The split between north and south Somers Town can be seen halfway along Chalton Street. A traditional market location, Chalton Street has lower Integration values at 800m than neighbouring main routes but a similar frequency of uses to Drummond Street or Eversholt Street. However, the use types on Chalton Street change from one end to the other, with the southern part nearest the Euston Road and the station serving both workers and visitors to offices nearby, and local residents. Northern Somers Town has become an entirely residential neighbourhood, with few non-residential uses at all.

Hanson concluded that Somers Town was not as isolated as “its immediate local circumstances – wedged between two great railway terminals – might lead one to expect.” (Hanson, 2000, p. 105). However, there has been change since Hanson’s 2000 paper, when she noted that there were light industrial premises in the south of the area and that most of the original pubs had survived. The majority have since closed, all in the northern half, and the industrial premises have also been replaced, partly by new buildings including extensions to St. Pancras and King’s Cross stations. There is a clear division between the southern part of Somers Town, which appears to interact economically with Euston Station and its passengers and is characterised by station-local uses, and the large institutional blocks at the British Library and the Francis Crick Institute, and the northern part of Somers Town which hosts entirely non-station uses. The estates in both Somers Town and the Regent’s Park Estate in West Euston consist of a combination of perimeter and free-standing housing blocks, with other uses found only in a few purpose-designed shopping parades.

	Mean Choice 3000m	**Mean Integration 800m**
1880s front of stations	1245150574	9243
2010s front of stations	788067437	8024
Percentage change	**2%**	**-9%**
1880s behind stations	768968210	7437
2010s behind stations	585349972	7761
Percentage change	**-6%**	**-25%**

Table 5.4: Euston, King’s Cross, St. Pancras land use values, 1880s and 2010s.[39]

Mean spatial values for non-residential land uses in both the 1880s and the 2010s show different patterns of spatial change either side of the stations. Mean Choice values have increased in front of the station a little, and fallen in back areas, also by a small amount.

[39] Lower value of the two time periods shown in red, for ease of comparison.

There is a greater different between areas with Integration values, which have fallen by a much large proportion behind the station than in front.

Land use		Count
Accommodation	1880s front	142
	2010s front	83
	1880s behind	56
	2010s behind	11
Eating	1880s front	138
	2010s front	214
	1880s behind	114
	2010s behind	109
Industrial	1880s front	420
	2010s front	130
	1880s behind	393
	2010s behind	62
Offices	1880s front	94
	2010s front	5996
	1880s behind	45
	2010s behind	2856
Public houses	1880s front	227
	2010s front	69
	1880s behind	181
	2010s behind	27
Retail	1880s front	2164
	2010s front	1610
	1880s behind	1784
	2010s behind	798

Table 5.5: Euston, King's Cross, St. Pancras land use count, 1880s and 2010s.[40]

[40] Lower value of the two time periods shown in red, for ease of comparison.

The increase in offices and corresponding decline in industry since the 1880s is clear. However, the decline in industry has been greater behind the stations – an 84 per cent decrease – than in front – a 69 per cent decrease. There are more than twice as many offices in front of the station in the 2010s than there are behind. The distribution of accommodation is even clearer in the 2010s, with 83 hotels and guest houses in front of the station, and only 11 behind.

While front areas have strengthened their city centre role, the opposite has taken place behind the stations. Falls in the number of premises in the Eating, Offices and Retail categories reflects the thinning out of non-residential uses in these areas, to an extent not seen south of Euston Road.

	Mean uses per segment (weighted by segment length)	Mean segment length per use (m)	Shannon Diversity Index
1880s behind stations	13.2	30.6	1.5
2010s behind stations	15.5	21.5	0.8
Percentage change	**18%**	**-30%**	**-45%**
1880s front of stations	11.3	21.5	1.4
2010s front of stations	18.7	17.9	0.8
Percentage change	**66%**	**-17%**	**-41%**

Table 5.6: Euston, King's Cross, St. Pancras non-residential land use density, 1880s and 2010s.[41]

Mean density for all non-residential land uses shows substantial differences in the way each area has changed. The total number of non-residential uses found in both areas increased between the 1880s and the 2010s, a trend which is reflected in the increased mean number of uses per street segment shown above. However, density has increased by a much greater degree in front of the station than behind, confirming that different patterns of land use change have taken place in the two areas. The increase in density in front of the station is nearly three times as large as that behind.

Mean segment length per use has decreased in both areas. Again, there are contrasting patterns, with segment length behind the stations falling by nearly twice as much as in front.

[41] Lower value of the two time periods shown in red, for ease of comparison.

Mean segment length per use would be expected to decrease with a rise in the total number of non-residential uses, but this change should be in proportion to the rise in uses per segment. Instead, the reverse is true, which suggests that reconfiguration of the street network behind the stations means that non-residential premises are located on more, shorter segments than is the case in front. This impact on land use distribution could be an indication of areas becoming more segregated over time, and non-residential uses thinning out, confirmed by the pattern of falling spatial values seen above.

The Shannon diversity index reveals a substantial fall in land use diversity on both sides of the stations. While this is larger in back areas, the overall change implies a wider effect unrelated to other patterns of land use thinning. Use numbers have increased in front areas while diversity has decreased. This is a surprising finding because, while the number of individual uses in front areas has increased greatly, there is now no significant difference in diversity between front and back. This could reflect a more homogeneous city less dependent on small, specialist businesses that its nineteenth century predecessor.

Social analysis

Social analysis has been carried out for the Euston, King’s Cross and St. Pancras neighbourhoods, using separate methods for the late nineteenth century and for the early twenty-first century. Figure 5.18 shows the 1898 Booth map. Social analysis has been carried out for the Euston, King’s Cross and St. Pancras neighbourhoods, using data from the Booth Survey (Booth, 1902) and the Greater London Authority’s Household Income Estimates for the 2000s (Greater London Authority Intelligence Unit, 2015).

The Booth map reveals the neighbourhoods around Euston, King’s Cross and St. Pancras Stations to be highly socially mixed, divided into areas with contrasting income levels. The areas mapped in Figure 5.18 include streets from each of Booth’s social categories, from Yellow (Wealthy) to Black (Lowest). The wealthiest streets are located in specific areas: the squares of central Bloomsbury, and the John Nash-designed areas of Fitzrovia around Great Portland Street and Regent’s Park. The only Yellow streets north of Euston Road are the Nash villas along the eastern edge of the park. There is a sharp social contrast between this narrow band of wealth and the much poorer Cumberland Market neighbourhood adjoining it to the east. Indeed, Nash himself complained as long ago as 1814 about the proximity of these terraces to slum housing behind (Dyos, 1982).

However, poverty and wealth are to be found in neighbourhoods on both sides of the stations. Between Great Portland Street and Bloomsbury the streets around Tottenham Court Road are poorer than either Bloomsbury or Fitzrovia, predominantly coloured Pink (Fairly comfortable) and Purple (Mixed) with streets in all the poorer categories. Similarly, areas of poverty are found immediately in front of St. Pancras and King’s Cross Stations, and further south into Clerkenwell, for example in the Saffron Hill slums around Warner Street. As Table 5.7 shows, there are in fact slightly more Black street segments in front of the station than behind, and slightly more Yellow segments behind than in front (although found exclusively along the eastern rim of Regent’s Park).

The Booth Survey notebooks report that the area in front of Euston Station, between Great Portland Street and Bloomsbury, is quiet and respectable with even the Rawlings Mineral Water Factory “clean looking, in contrast to the majority of mineral water factories we have passed” (Booth, 1902, B355, p. 103). The area is not solely residential and Great Titchfield Street, for example, has cabinet makers, music printers, packing case factories and a street market.

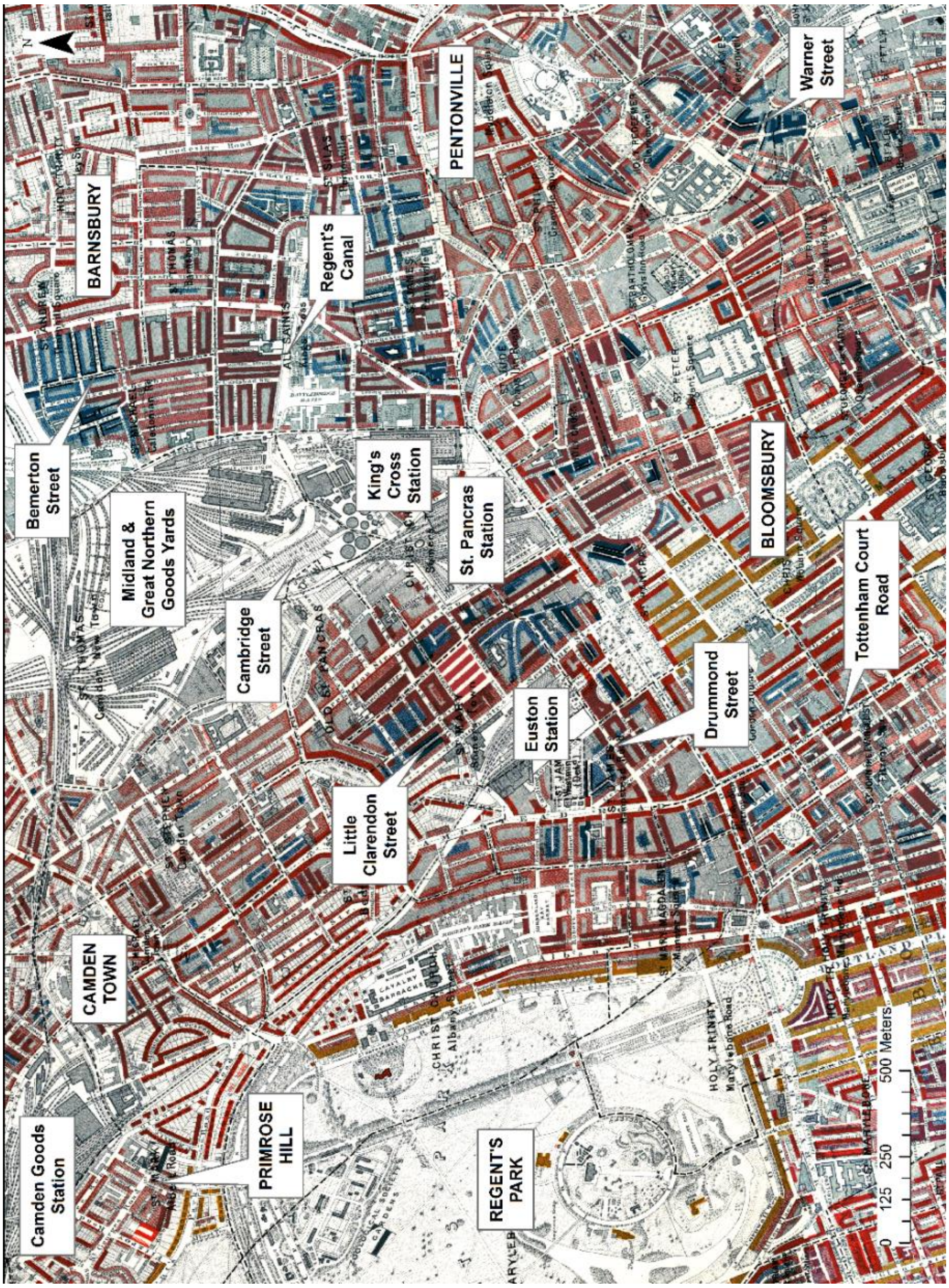

Figure 5.18: Euston, King's Cross, St. Pancras 1898, Charles Booth Survey map.[42]

[42] Source: Charles Booth Online Archive, London School of Economics. Labels added for the purposes of this study.

However, some smaller streets are classified as poorer and described as dirty and badly maintained, while streets that have more prosperous colours on the map, such as the Red southern end of Great Portland Street, are also home to such premises as “a massage establishment of more than doubtful repute” (Booth, 1902, B355, p. 105) and “a hotel used as a house of convenience” (Booth, 1902, B355, p. 107). The Booth survey discovers a number of such hotels around Great Portland Street and Langham Place where “many women who walk Regent Street and Piccadilly live” (Booth, 1902, B355, p. 109).

Streets in lower social categories are almost entirely smaller side streets and mews. Saville Street, for example, off Langham Place is “a savage street. Drunken and criminal. Thoroughly disorderly” (Booth, 1902, B355, p. 137). The surveyors describe a decline in local markets because “the classes that use them have been driven out of the district by the building of warehouses, workshops and flats” (Booth, 1902, B355, p. 117). The commercialisation of the area has, they claim, also “drained the better classes from surrounding streets” (Booth, 1902, B355, p. 117). Fitzroy Square, with houses very similar to those in the Bloomsbury Squares, is “not as good as it used to be” (Booth, 1902, B355, p. 131). The area is in decline, and the 1898 survey and map in Figure 5.18 shows more Black and Dark Blue streets than its 1889 predecessor.

Bloomsbury, despite its wealthy, mainly residential squares, also has a small number of alleys with lower classifications. For example, Little Gower Place, against the north wall of University College, has “costers, casuals, windows dirty, broken, doors open; bread and vegetables lying about, chickens and barrows, very poor” (Booth, 1902, B355, p. 123).

Euston Road has “houses of questionable repute and some regular brothels” (Booth, 1902, B355, p. 123) while the stretch in front of Euston Station is mostly occupied by industry, particularly marble masons and zinc workers. Further east, hotels with similar reputations are also found in front of King’s Cross and St. Pancras Stations. The King’s Cross neighbourhood, to the east of Bloomsbury, has some areas of intense poverty. Around Tonbridge Street, “a rabbit warren” and “’a fine get away from the Euston Road’ for thieves” (Booth, 1902, B354, p. 47), is a Ragged School and a collection of ragged children, and the area has a ‘home for fallen women’. The streets are mixed, with some described as respectable but others clearly less so. The surveyors lay some of the blame for the state of the area immediately in front of the stations on the presence of the railway: “the number of streets in the Argyle Square area containing disorderly houses to supply a provincial demand arising (?) by the GNR at King’s Cross and St. Pancras by the Midland” (Booth, 1902, B354, p. 51).

Behind the stations, the Booth survey also identifies areas where poverty is closely associated with the presence of the railway. In the Cumberland Market district, partly bounded as the survey points out by the railway line to Euston, there has been "a marked decay both social and moral, due partly no doubt to the fact that houses are in many cases almost too old for habitation. I hear that most of this property belongs to the L.N.W. Ry [London and North West Railway] and the fact that at any moment it may be required for railway extensions is against improvement" (Booth, 1902, B354, p. 37). The surveyor identifies long-term impermanence as a factor that affects not just streets but also neighbourhoods adjacent to railway lines, casting a blight over their future. The neighbourhood also experiences another effect of the nearby railway, with the surveyor noting that "Another marked feature of the area is the number of brothels or semi-brothels in the vicinity of the station" (Booth, 1902, B354, p. 37), a phenomenon already noted above. The adjacent area around Drummond Street, between Hampstead Road and Euston Station, is also relatively poor, with side streets coloured Purple and alleys and courts in lower categories.

Somers Town, between Euston and St. Pancras Stations, is also a poorer neighbourhood. The survey notes "a protecting line of respectability" (Booth, 1902, B356, p. 105), marking the northern edge of the neighbourhood where the neighbourhood becomes less constrained by the stations either side. Below this line Somers Town is "a dark, if not very black corner of London" (Booth, 1902, B356, p. 107). Little Clarendon Street, marked Black, is known locally as "Little Hell" with "a good many prostitutes and amateurish thieves" (Booth, 1902, B356, p. 109). Somers Town is described as a poor rather than a criminal neighbourhood, but the notebooks also include an interview with an Inspector based at King's Cross in which he claims that "Hoxton, Clerkenwell and Somers Town include half the criminals not of London only but of the provinces" (Booth, 1902, B353, p. 221).

In the south-east section of Somers Town, the survey records "a good deal of change owing to Midland extensions" (Booth, 1902, B356, p. 115) and the demolition of several streets for the Midland goods depot. Several streets to the north of the depot, closest to the railway, have also become depopulated, replaced by services such as stables which were related to the station and the depot. The area of Somers Town around the Chalton Street market is livelier, with people coming from some distance to sell there: "many Jews come from Whitechapel, selling draperies for the most part" (Booth, 1902, B356, p. 123). However, the streets here are poor too, and there are several reports of brothels either suspected or recently closed down. At the time of the survey, the London County Council was beginning demolitions for road widening on Church Way (now Churchway) next to Euston Station. The surveyors comment that "Although the Church Way improvement will effect a very wholesome clearance, it is difficult to see that the new thoroughfare… will be of great use. The area will still be very much tucked away" (Booth, 1902, B356, p. 139). The surprising inaccessibility of Somers Town, adjacent to two of London's largest terminals and some of its busiest roads, is confirmed by the spatial analysis above, both in the 1880s and today.

Behind St. Pancras and King's Cross Stations the Booth map shows the railway lands as a large, uncoloured area, with almost no residents and occupied entirely by railway sidings and associated industry: "a wilderness of coal depots" (Booth, 1902, B356, p. 141). Among the few housing blocks is one on Battle Bridge Road, built by the Great Northern Railway for its workers. In the middle of the railway land, then as now, was Old St. Pancras Church with its relocated gravestones, "silent reminders of the encroachments of the Midland" (Booth, 1902, B356, p. 143).

East of King's Cross Station, the streets between Pentonville Road and the Regent's Canal have a mixture of poverty and Pink streets. Caledonian Road is a busy shopping street, while roads closest to the station are more directly influenced by the railway. Wharfdale Road has "a colony of railway porters" (Booth, 1902, B353, p. 201) and other streets nearby are inhabited by railway workers and cabmen. Railway Street, adjacent to King's Cross Station is the poorest in the area with a "great mess of meat, bread, tins, paper in the street," (Booth, 1902, B353, p. 199) railway workshops and a large poultry slaughterhouse.

North of Regent's Canal, streets close to the station around Bemerton Street combine poverty with railway housing. Bingfield Street is "the railway barracks" and "fairly respectable but dismal looking" (Booth, 1902, B349, p. 83). It is described as "a very rough district" which has fallen down the category list across the board since the first survey visited. It is also dominated by King's Cross and its depots, with "inhabitants by profession cabmen, carters, navvies, railway porters, market porters" (Booth, 1902, B349, p. 89). Further east, away from the railway, Barnsbury is a wealthier area with large, formal squares and crescents, such as Thornhill Square, coloured Red and secondary streets coloured Pink. It is socially distinct from the streets between Caledonian Road and the station.

Tables 5.7 and 5.8 show segment and spatial data for Euston, King's Cross and St. Pancras, related to the Booth categories.

		Count	Percentage of total segments	Mean segment Length	Choice 3000m	Integration 800m
Yellow: wealthy	Front	50	4%	50	543783149	236671
	Back	62	5%	61	1185491617	140864
Red: well-to-do	Front	509	43%	56	639760014	248369
	Back	370	30%	57	877270124	239805
Pink: fairly comfortable	Front	389	33%	60	670525040	251999
	Back	402	32%	60	478589348	232025
Purple: mixed	Front	159	13%	55	642132966	250184
	Back	261	21%	58	336887804	230841
Light Blue: poor	Front	36	3%	52	780939449	254357
	Back	101	8%	53	222500317	230821
Dark Blue: very poor	Front	15	1%	58	454430325	251365
	Back	22	2%	42	391620409	233136
Black: lowest class	Front	27	2%	60	472819229	243414
	Back	22	2%	77	50548385	225795
Population mean	Front	N/A	N/A	57	666009543	8613
	Back	N/A	N/A	58	535157893	7269
n=	Front	1186				
	Back	1240				

Table 5.7: Mean spatial data and Booth, Euston, King's Cross, St. Pancras 1898.[43]

There are consistent spatial differences either side of the stations. Although overall mean segment length is similar, difference emerge in specific categories. Mean segment length is shorter in front of the station for Purple and Dark Blue streets, suggesting that poorer streets

[43] Lower value of the two time periods shown in red, for ease of comparison.

(although not the very poorest) are found further away from the main streets of the Bloomsbury and King's Cross grids. The Booth survey confirms the existence of such back streets and alleys. Behind the station, poorer segments are more likely to be found on longer street segments too.

Mean Choice 3000m values are lower behind the stations for segments in the poorer categories, reflecting the overall balance of poverty and Choice values. However, across all categories Integration 800m values are lower behind the stations. This strongly suggests that Integration is closely linked to the difference in social character between the two areas. Neighbourhoods behind the stations are both poorer on average than those in front, and less well integrated, a likely effect of the various forms of separation created by the railways.

Figure 5.19 shows clusters of lower income LSOAs around and between the three stations. As Table 5.8 shows, the station neighbourhoods do not include any LSOAs in either the top income category or in the third highest category. Three LSOAs on either side of the stations fall into the second highest category and these are located in Barnsbury and on the southern edge of Regent's Park, where the wealthiest areas were also found in 1898. All the LSOAs in Bloomsbury fall into middle income categories, while King's Cross has a slightly lower income profile with a number of areas around the Gray's Inn Road falling into the second lowest category.

Behind the stations, north of Euston Road, there are substantial areas of poverty which fall into the lowest two income categories almost in their entirety. West Euston is still divided between the Nash villas on the west side and the Regent's Park Estate, marked on the map by the lowest categories. The Drummond Street triangle falls into the second lowest categories. Somers Town falls entirely within the bottom two categories, and the low income areas now spread further north over the "boundary of respectability" described in the Booth survey. These streets, between Camden High Street and Regent's Canal, contain a series of post-war estates built to replace the nineteenth century terraces: the Bayham Place, College Place and Curnock Street Estates. Somers Town, as discussed above, is a neighbourhood repeatedly redeveloped both for social housing and railway uses during the twentieth century.

East of York Way, the Caledonian Road neighbourhood principally consists of LSOAs in the lowest two categories, although the streets immediately east of the station are in a higher category, an area redeveloped as part of the wider King's Cross rebuilding programme.

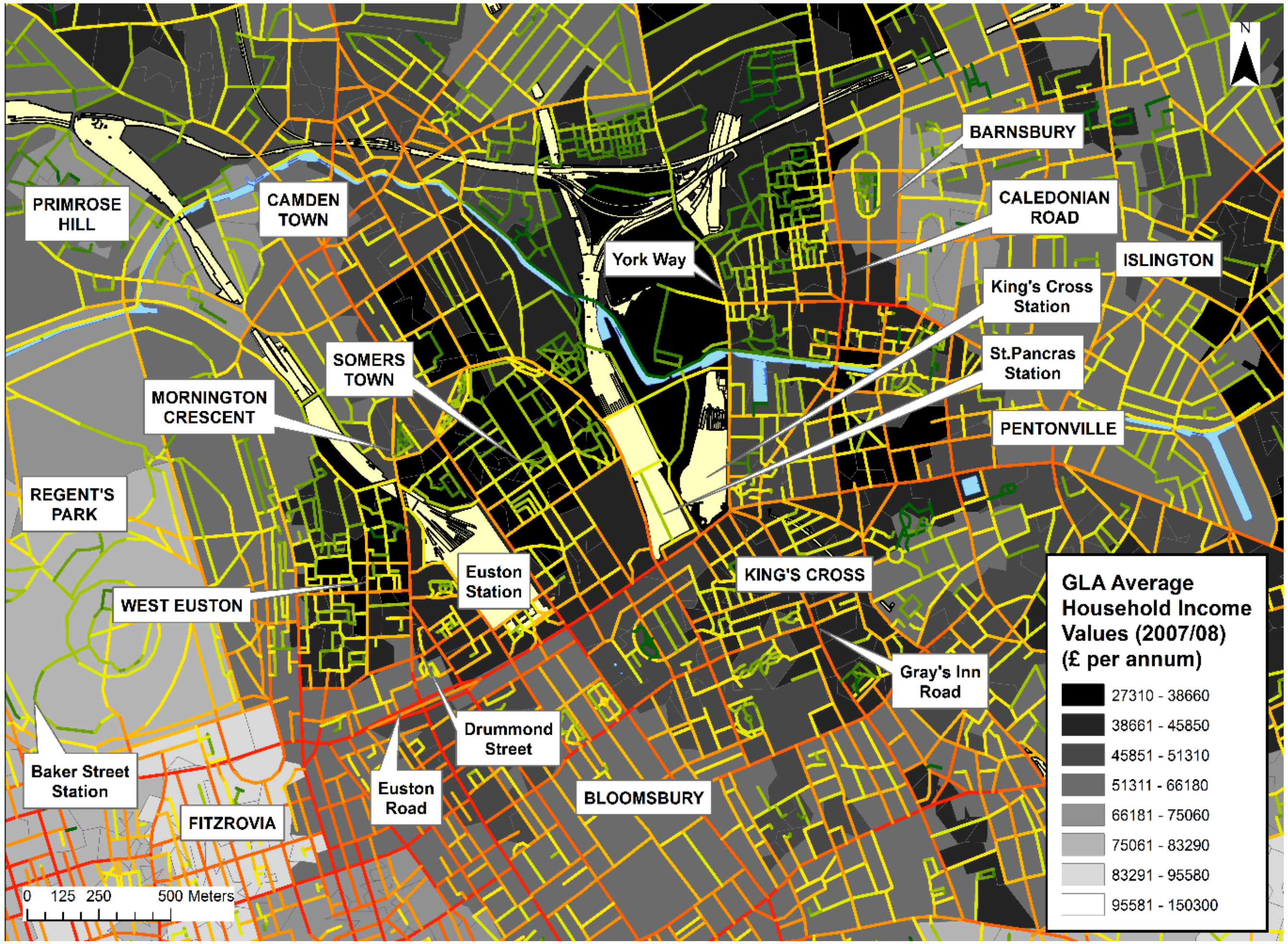

Figure 5.19: Euston, King's Cross, St. Pancras, GLA Household Income 2007/08, Integration 800m.

Table 5.8 shows segment data and spatial data by estimated income band. Mean segment length is consistently shorter behind the stations, for all but one category. Because the bulk of segments behind the stations are in the bottom three categories, the contrasting characteristics of the street network either side of the station remain related to income levels, as they were in the 1880s. Four of the six income bands are associated with lower Choice values at 3000m behind the stations, and mean Integration values at 800m are lower for all categories except the highest.

Mean household income estimate	Neighbourhood	Count	Percentage total segments	Mean Segment Length	Mean Integration 800m	Mean Choice 3000m
£83,291 – £96,130	Front	3	0.1%	26	5122	70221247
	Back	3	0.1%	63	12997	284948938
£66,181 – £75,060	Front	236	4.3%	59	11017	98220067
	Back	104	1.9%	57	5372	58482772
£51,311 – £66,180	Front	941	17.1%	60	8951	81241597
	Back	532	9.7%	60	6800	72915952
£45,851 – £51,310	Front	604	11.0%	53	7717	63457419
	Back	612	11.1%	48	5715	50441850
£38,670 – £45,850	Front	507	9.2%	54	7514	75334410
	Back	1085	19.7%	50	5186	50510298
<£38,669	Front	16	0.3%	77	8395	118490033
	Back	854	15.5%	50	5065	41697217

Table 5.8: Euston, King's Cross, St. Pancras, GLA Household Income 2007/08 with spatial data.[44]

The diversity of income is not as great behind the stations, meaning that these neighbourhoods are both poorer and less economically diverse than those in front. This has become more pronounced that in the late nineteenth century. While Bloomsbury and King's

[44] Lower value of the two time periods shown in red, for ease of comparison.

Cross have raised their income profile, with the lowest categories of poverty almost entirely disappearing. West Euston, Somers Town and Caledonian Road have remained predominantly lower income areas, with the lowest income band now encompassing areas recorded by the Booth Survey as Red and Pink. The divisions marked by the railway have become more pronounced over time.

Discussion and conclusions

Analysis of the neighbourhoods behind Euston, King’s Cross and St. Pancras Stations shows the extent to which the three stations and their associated infrastructure dominate the urban grain of the area. The railway lines, together with the Regent’s Canal and Euston Road, create a series of ‘railway islands’, areas surrounded by a combination of railway stations, lines, water and main roads.

Euston Road has, in fact, five railway terminals along its full length, including Marylebone and Paddington Stations on its continuation, as Marylebone Road. The road developed as a bypass for inner London partly because it was already established as the northern boundary of the city centre, a role reinforced by the 1846 Royal Commission’s decision to exclude the railways from areas to its south. Its subsequent widening in the 1970s cemented its role as an urban barrier, introducing structures intended to maximise traffic speed including multiple lanes, flyovers and pedestrian underpasses. The contrast between neighbourhoods located south of Euston Road and those to the north is clear. Bloomsbury and King’s Cross have the spatial, economic and social characteristics of central London. West Euston, Somers Town, Caledonian Road and associated areas behind the stations were, on average, poorer and more segregated in the 1890s and have become more so over time. These neighbourhoods have also lost a higher proportion of their land use density and variety than those areas south of Euston Road.

Defining distinct neighbourhoods in the two areas makes the nature of the separation caused by the railway system apparent. While Bloomsbury and King’s Cross are easily defined, marked by agreed local electoral boundaries, neighbourhoods behind the station are small and separate, despite physical proximity, and include areas that, because of their lack of accessibility, are uninhabitable and suitable only for transport and industrial use. West Euston is ringed by Euston Station, its approaches, Regent’s Park and Euston Road. Somers Town lies between Euston Station, Euston Road and St. Pancras Station, and includes its former Goods Depot site. Caledonian Road has railway lines and junctions to the north and west, and the canal to the south. All three neighbourhoods continue to experience periodic disruption from large railway construction projects, most recently the Channel Tunnel Rail Link and the rebuilding of St. Pancras Station, with significant demolition for High Speed Two and Crossrail currently under discussion and development of former goods sites in progress. All three neighbourhoods have, throughout their existence, been characterised as undesirable places to live, with many decades during which they hosted dirty steam trains and dirtier industries. Many streets in these areas, rated as poor and very poor by Charles Booth in his 1880s and 1890s surveys, became so at least partly because of the construction and expansion of the railways, which not only caused physical disruption in the short-term but, in the longer-term, introduced anti-social uses from coal drops to gas works, and influenced the social character of the back station neighbourhoods by making them undesirable places to live. These areas have remained poor ever since. Even those streets that were more prosperous suffered from proximity to the railway lines. Soot from the nearby Euston approaches stained the houses of Mornington Terrace in Camden into the 1980s, and residents protested in Parliament about the pollution.

Land use mapping highlights the contrast between the monolithic station structures of the station and the areas of mixed use nearby. The densest agglomerations of activity are found in a small number of streets where the remnants of street grids that surrounded the stations can be found. The Drummond Street triangle and the southern Caledonian Road have smaller plots and more complex, deeper block structures which provide a larger number and greater range of uses than either the larger blocks lining Euston Road, or the free-standing housing blocks on the residential estates further behind. The blight of long term impermanence – identified by the Booth Survey in Cumberland Market – can still be seen in the vicinity of Euston Station, around Drummond Street, where High Speed Two demolition is planned, and on Eversholt Street where blocks optioned for Crossrail Two are seedy and in poor repair.

Spatial analysis makes it possible to see how Hillier *et al.*'s "negative attractor" effect influences streets behind the stations (Hillier *et al.*, 1993). Choice values are high along north-south main roads behind the station, but a lack of east-west routes reduces Choice on streets in the neighbourhoods behind. Integration values show Bloomsbury and King's Cross as centres, with high values on the main segments of the entire grid. Behind the stations, these high values extended to grid areas in the 1880s which, by the 2010s have disappeared, leaving no integrated centres between the Euston Road, Camden Town and Barnsbury. This large area, crossed by multiple railway lines, contains a predominance of housing originally built for council tenants in a series of pre- and post-war estates.

Booth’s survey found poverty both sides of the stations, although neighbourhoods behind were poorer overall. Since the end of the nineteenth century, West Euston, Somers Town and Caledonian Road have become poorer, with areas of lower income more widely spread, while poorer areas around Tottenham Court Road and King’s Cross have become better off over the same period.

The three Euston Road terminals serve central London, directing passengers from their exits mainly into the streets to the south. The areas behind are geographically just as close, but are harder to access because of the way the station have been designed. They are complex places, difficult to navigate, and have become more so over time. They have lost shops, cafés, pubs and business, and become poorer. The contrast is clear between places shaped by the railways and places they spared.

The next chapter analyses the areas around Paddington Station, one of London’s early terminals, and around Marylebone Station, London’s last terminus, located a short distance away to the east of Edgware Road.

Chapter Six: Paddington and Marylebone Stations

Introduction

Paddington and Marylebone Stations lie just over 1km apart, north of Hyde Park and west of Regent's Park. Figure 6.1 shows the location of the two stations, with their infrastructure and surrounding neighbourhoods marked. The neighbourhood usually described as Paddington[45] occupies the area south of the station, between its frontage and Bayswater Road, the northern edge of Hyde Park. Bayswater itself is located to the west, also south of the station and the railway lines.

Paddington Station is located immediately to the south of the elevated Westway (the A501). The station's approaches share a transport corridor with this arterial route, London's main road connection to the north-west. Paddington is also an important location for the canal network. Less than a kilometre to the north of the station, Little Venice is the meeting point for the Regent's Canal, the Grand Junction Canal and a short branch that passes along the eastern station flank to form Paddington Basin. The Grand Junction Canal uses the same north-west corridor, but its course loops north, away from the route of the Westway and the railway, creating areas surrounded on all sides by transport infrastructure. Westbourne Green is an island between the railway, the Westway and the canal. Paddington Green is enclosed by a combination of two canal branches, the Westway, the Edgware Road (A5) and Paddington Station.

The immediate area around Marylebone Station is defined by Regent's Park to the east, the Regent's Canal to the north, Edgware Road (A5) to the west and Marylebone Road to the south. The station, the final London terminus to be constructed, was named after the long established neighbourhood of Marylebone to the south. This is the area still known as Marylebone, while the area around the station, north of the Marylebone Road (A501), is known as Lisson Grove, after the main road at its centre.

[45] The area between Paddington Station and Hyde Park, now generally known as Paddington, was originally named Tyburnia. This name became defunct, leaving the area with a minor identity crisis. As a result streets nearest to Hyde Park are sometimes referred to as Lancaster Gate, after the Central Line station, while occasional attempts are made to revive Tyburnia as an active name.

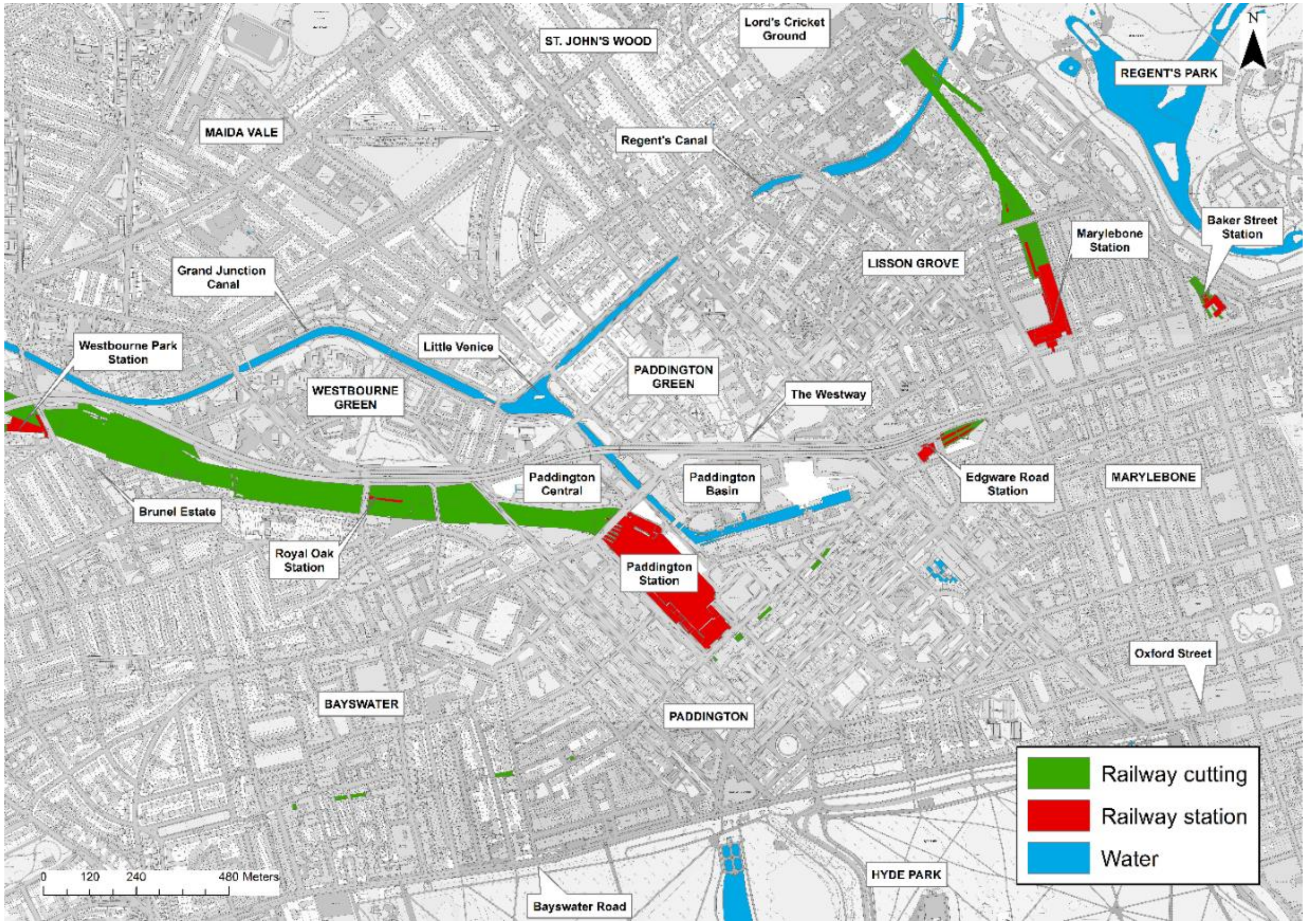

Figure 6.1: Paddington and Marylebone Stations and infrastructure.

Image 6.1: Paddington approaches from Bishop's Bridge.

The railway lines approaching both stations create voids in the cityscape for some distance behind (shown in green in Figure 6.1). These approaches have limited crossing points, and therefore form barriers to movement. The approaches to Paddington are contained in a wide cutting, measuring 90 metres across at the station throat, which continues for three miles west, ending at Old Oak Common. These approaches are wide enough to entirely contain Royal Oak Station and the Hammersmith and City Underground line, which is passed on either side by main and suburban lines (and in future by Crossrail, under construction at the time of writing). A pedestrian bridge and four road bridges — Bishop's Bridge, Lord Hill's Bridge, Ranelagh Bridge and Westbourne Bridge —are the only routes across the 1.6km of track between Paddington and Westbourne Park stations.

Image 6.2: Marylebone approaches from Rossmore Road, Lisson Green estate on left.

The approaches to Marylebone also run above ground behind the station but for a shorter distance, with a cutting of just under 1km to Marlborough Road, before the railway enters the 1.5km Lord's Tunnel to Finchley Road. These approaches are crossed in only two places: by the Rossmore Road bridge behind the station, and by the Regent's Canal towpaths which pass beneath the lines.

History

Paddington Station is the terminus for services to the West Country and South Wales. Its tracks "go out towards the sunset" (Jackson, 1972), crossing west London via Kensal Green, Acton and Ealing to Reading, the Thames Valley and all destinations west. The first station in the area opened in 1838, a temporary building north of the current station, on a site that later became Paddington Goods Yard. It was the entry point to London for the Great Western Railway, a venture intended to help Bristol compete with Liverpool as the main port for Atlantic trade. The company was set up in 1833 and the first section of the route, from Paddington to Taplow, in Buckinghamshire, was built under the direction of Isambard Kingdom Brunel, opening in 1838. The current station, a much more substantial structure, opened in 1854. It was designed by Brunel with glass roofed spans strongly influenced by Joseph Paxton's Crystal Palace (Cherry and Pevsner, 1991). The world's first underground line, the Metropolitan Railway, started from Paddington, with the first section to Farringdon opening in 1863. It was then extended in both directions several times during the remainder of the nineteenth century, cementing Paddington's place as an important node in the new London public transport network. By 1833 local residents were already making formal complaints about the impact of the congested Edgware Road on their property values (Baker, Bolton and Croot, 1989), as the village of Paddington became irreversibly drawn into the rapidly expanding metropolis.

The new Great Western line terminated at what was then the edge of London. Figure 6.2 shows that in the 1820s the triangle of land between Edgware Road and Hyde Park, land owned by the Bishop of London, contained little more than Paddington village with its church and green. This had been a rural area, and a statue of Sarah Siddons on Paddington Green is a reminder that in the early nineteenth century it was a suitable country retreat for the most famous actress of her time. However, the Grand Junction Canal company had already signalled the new industrial age with the completion of the Paddington Canal Basin, in 1801. By the 1820s streets and squares were being laid out between Praed Street and Hyde Park for a new neighbourhood planned by the architect Samuel Pepys Cockerell, and initially known as Tyburnia. An omnibus service opened from Paddington to the Bank of England in 1829, with capacity for 18 passengers (Rasmussen, 1982, p. 132). Paddington Station was built on the next vacant plot to the west of the new neighbourhood, its orientation determined by the route of the Harrow Road and the site of the Basin.

Paddington Station faces on to Praed Street, with entrances either side of the Great Western Hotel which sits between the station concourse and the street. The station was expanded in the early twentieth century, with a fourth span added to Brunel's original three in 1915, on the east side of the station. As Figure 6.3 shows, the station and its associated structures, approaches and sidings covered their largest area from the late nineteenth century when both the Goods Station and the Mileage Yard were in operation.[46] The Regent’s Canal Dock at Paddington Basin was also a busy transfer site for goods and materials, with warehouses, wharves, a coal depot and a factory. It was connected via the Grand Junction Canal to Birmingham, and via the Regent’s Canal to the Docks at Limehouse.

[46] Mileage yards handled goods using a separate system from a main goods station, under which customers paid for rail transport but unloaded the wagons themselves.

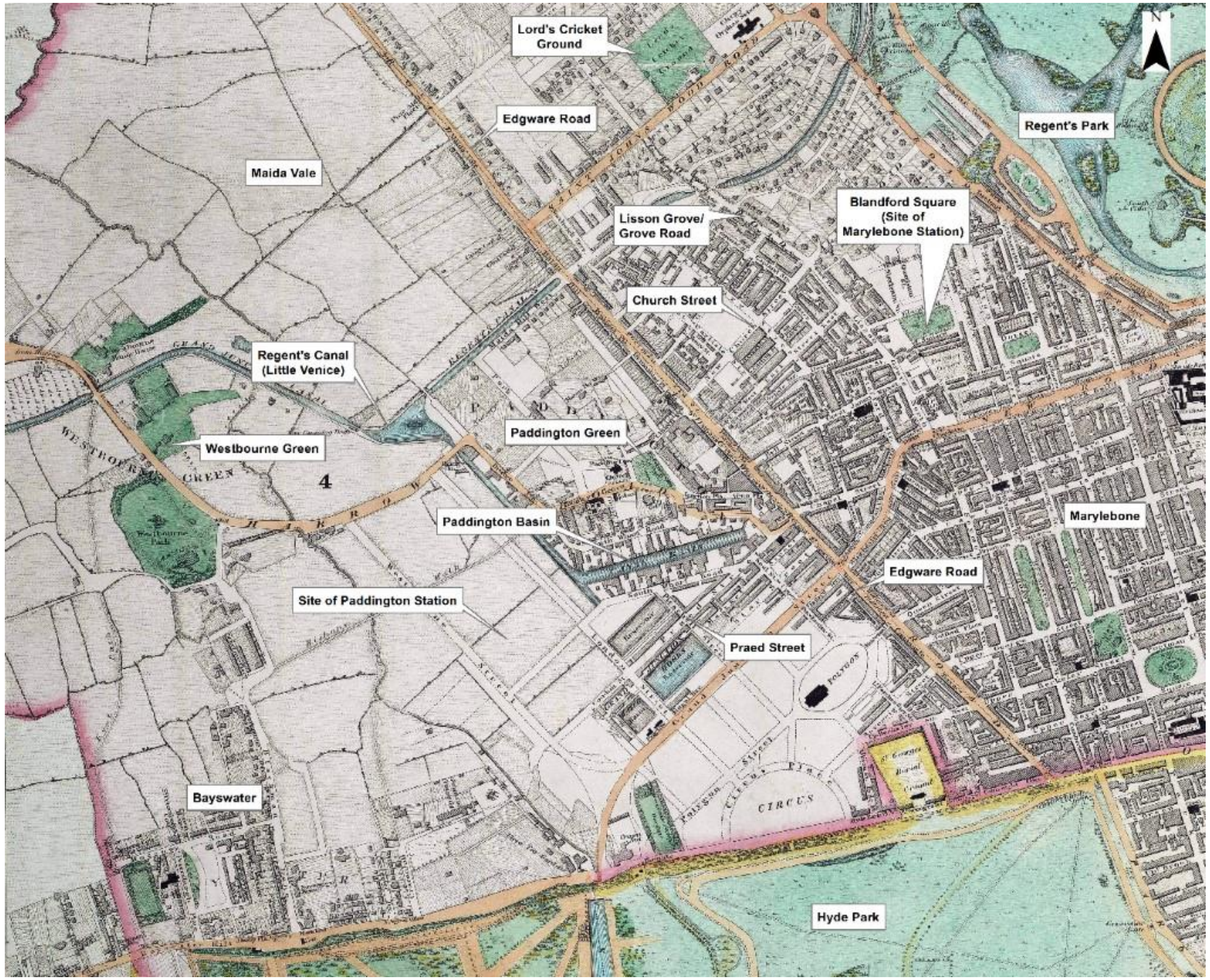

Figure 6.2: Paddington and Marylebone area, Greenwood Map 1827.

By the end of the 1960s, all these sites had closed. The Mileage Yard was redeveloped as the Brunel Estate during the early 1970s, but the canal basin and the goods sidings lay derelict for more than three decades until redevelopment began in 1998. The Paddington Central offices now occupy the Goods Station site, while the canal basin has been developed as Paddington Basin and Merchant Square, with final construction phases underway at the time of writing.

Marylebone Station was built much later than Paddington, opening in 1899. It was London's final grand railway project, and the most expensive and disruptive. After 20 years of negotiations over a London terminus for the jointly-owned Manchester, Sheffield and Lincolnshire and Metropolitan Railways, a Parliamentary bill was passed in 1893 allowing work to begin. The Great Central Railway Company was formed to build a new connection from Finchley Road to the Marylebone site. Part of this was in a tunnel, but the final section from St. John's Wood to the station was driven through a densely populated area of established streets.

North of the Regent's Canal the line ran through the upmarket villas of St. John's Wood, detached and semi-detached with large gardens, where four streets were demolished. South of the canal the terraces around Blandford and Harewood Squares were much more densely laid out. Here a total of 28 streets and two squares, as well as the large Portman Buildings blocks of flats, were demolished. A further four blocks north of Church Street were cleared for the Marylebone coal depot. Overall 4,488 people were reported to have been displaced by the clearances (Jackson, 1972). The Wharncliffe Gardens estate, just beyond the demolition area in St. Johns' Wood, was built by the railway company as compensatory housing for more than 2,000 people. However, according to the Booth Survey "None of the people displaced from Lisson Grove have gone into them. The rents have been raised from those charged when they were first built" (Booth, 1902, B357 p. 233).

The Great Central Railway was never the envisaged success, and the expense of the project caused financial strain well before completion, apparent in the design and scale of Marylebone Station which is surprisingly modest for a London terminus. The company was forced to save money by employing its own engineer rather than an architect to produce the station designs. Nor does the station occupy the full space implied by its frontage, with a third of the area behind taken up from the start by housing, now also by offices. Marylebone does not front on to the nearest main street, the Marylebone Road, but is hidden a block to the north behind the Great Central Hotel, the railway hotel built at the same time as the station.

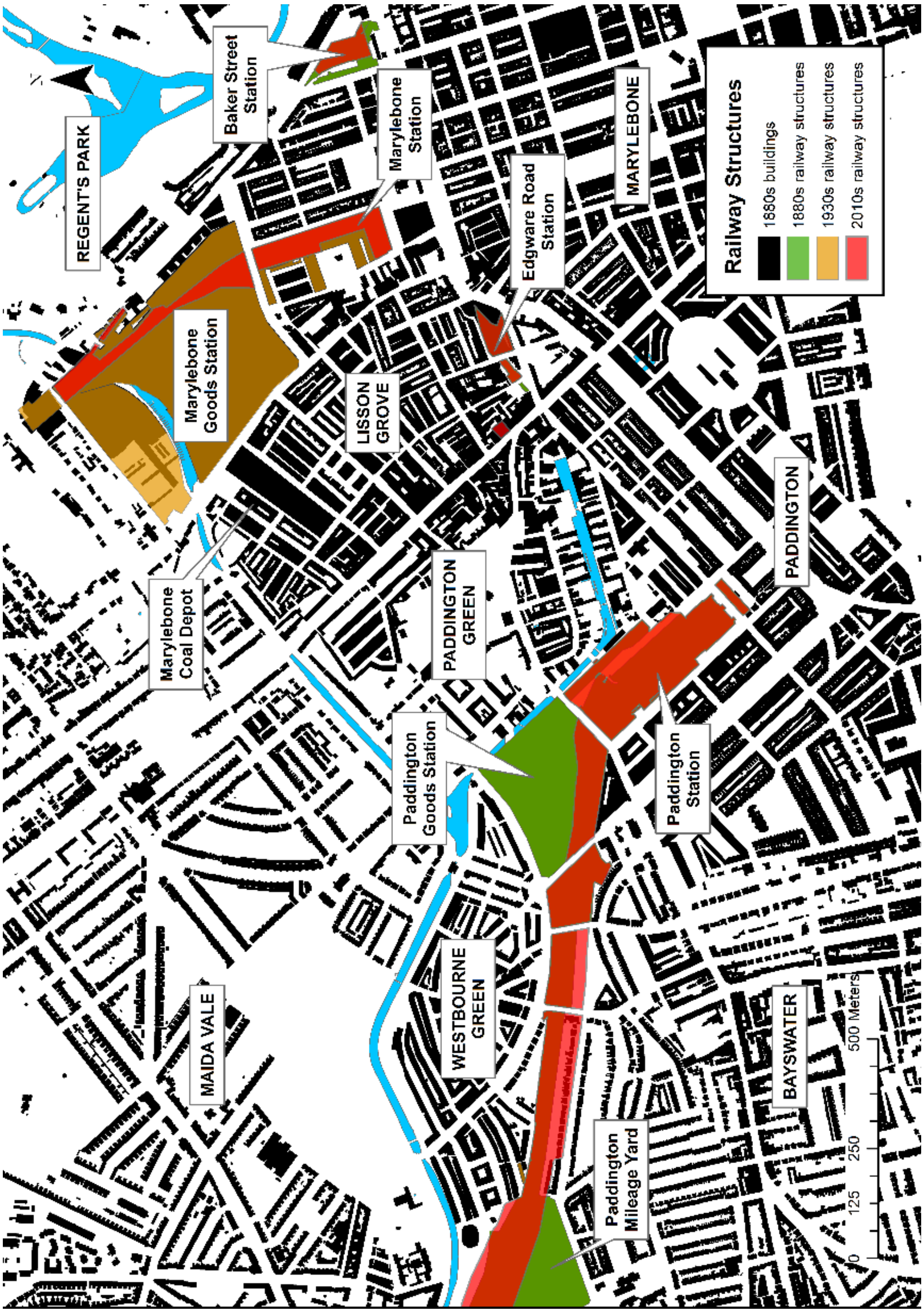

Figure 6.3: Paddington and Marylebone Stations expansion 1880s-2010s.

Paddington and Marylebone neighbourhoods

Paddington Station faces south, with its main entrances on Praed Street. However, there are also exits on the north side of the station, beside the station throat. These originally served Bishop’s Bridge Station underground station, and are still closest to the Metropolitan Line platforms at Paddington. Marylebone Station has a simpler layout, with a two exit through the station frontage, one on the west side, and no other routes out of the station. There are no exits on the north side of the station, where the station throat enters the platforms. The surroundings of both stations are mapped, as they were in 2014, in Figures 6.4 and 6.5

Neighbourhood boundaries have been defined to analyse street network change either side of the two stations, shown in Figure 6.6. Facing Paddington and Marylebone Station are the neighbourhoods of Bayswater (bounded in the west by Pembroke Villas, Chepstow Road and Westbourne Park Road); Paddington (between the station and Hyde Park, with Edgware Road its eastern edge); and Marylebone (between Edgware Road and Marylebone High Street/Marylebone Lane). All three areas are bounded to the south by Bayswater Road/Oxford Street, and to the north by Marylebone Road/The Westway and the Paddington approaches.

The neighbourhoods behind the station – Westbourne Green, Paddington Green and Lisson Grove – have the Paddington approaches and the Westway/Marylebone Road as their southern boundary. Westbourne Green is bounded to the north by Harrow Road, Sutherland Avenue and Warwick Avenue, the edge of Maida Vale. The Brunel Estate is also included as part of Westbourne Green. Although it is on the south side of the railway lines, it was built on the ex-Great Western Railway Mileage Yard and is therefore included within the boundaries of the railway lands. It also forms part of the same local electoral ward as Westbourne Green.

Paddington Green includes Paddington Basin and is bounded to the north by Clifton Gardens and to the south by Praed Street, which runs across the Paddington Station frontage, and separated from Lisson Grove by Edgware Road (the A5). Lisson Grove is bounded by Marylebone Road to the south and St. John's Wood Road to the north.

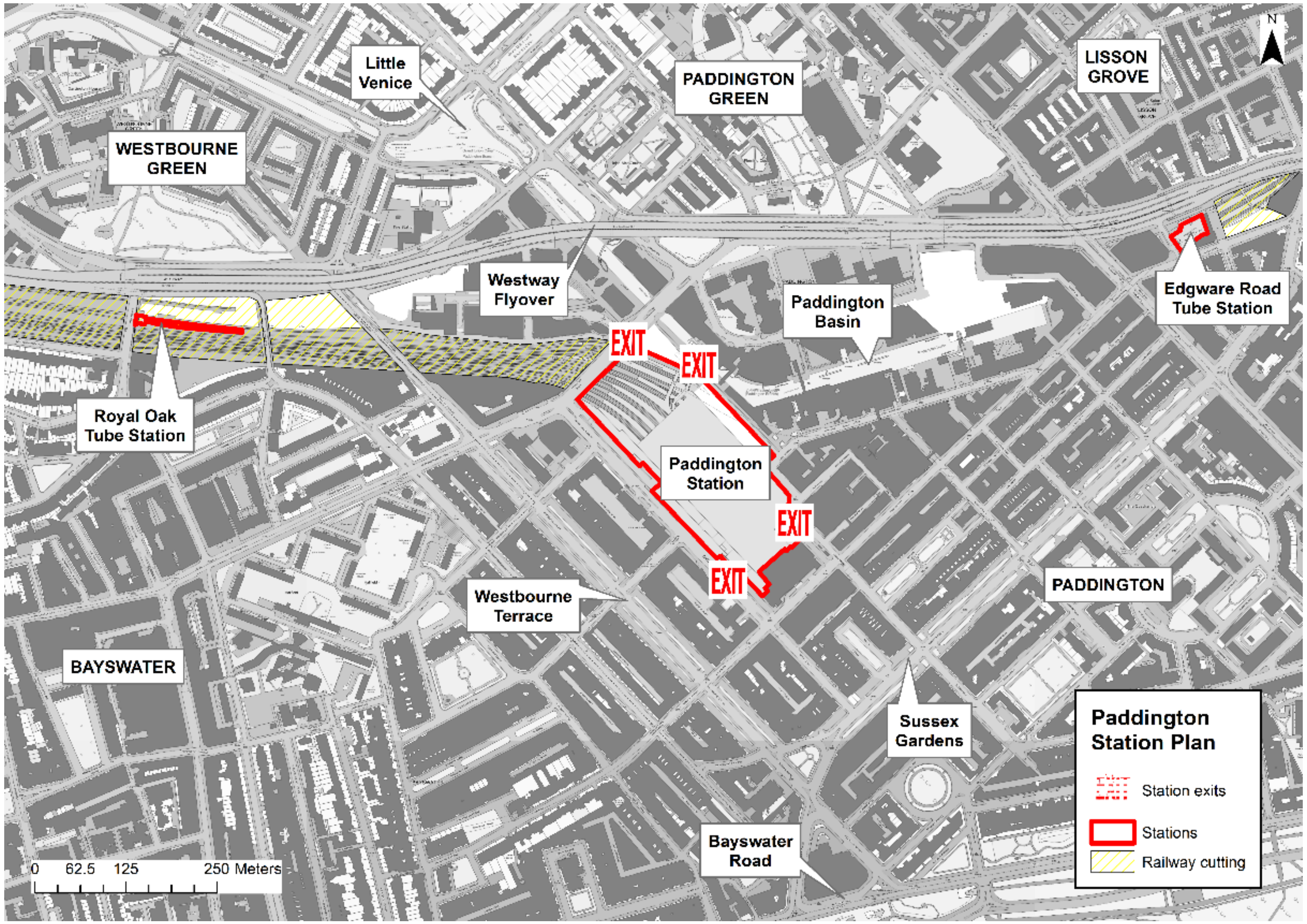

Figure 6.4: Paddington Station plan 2014.

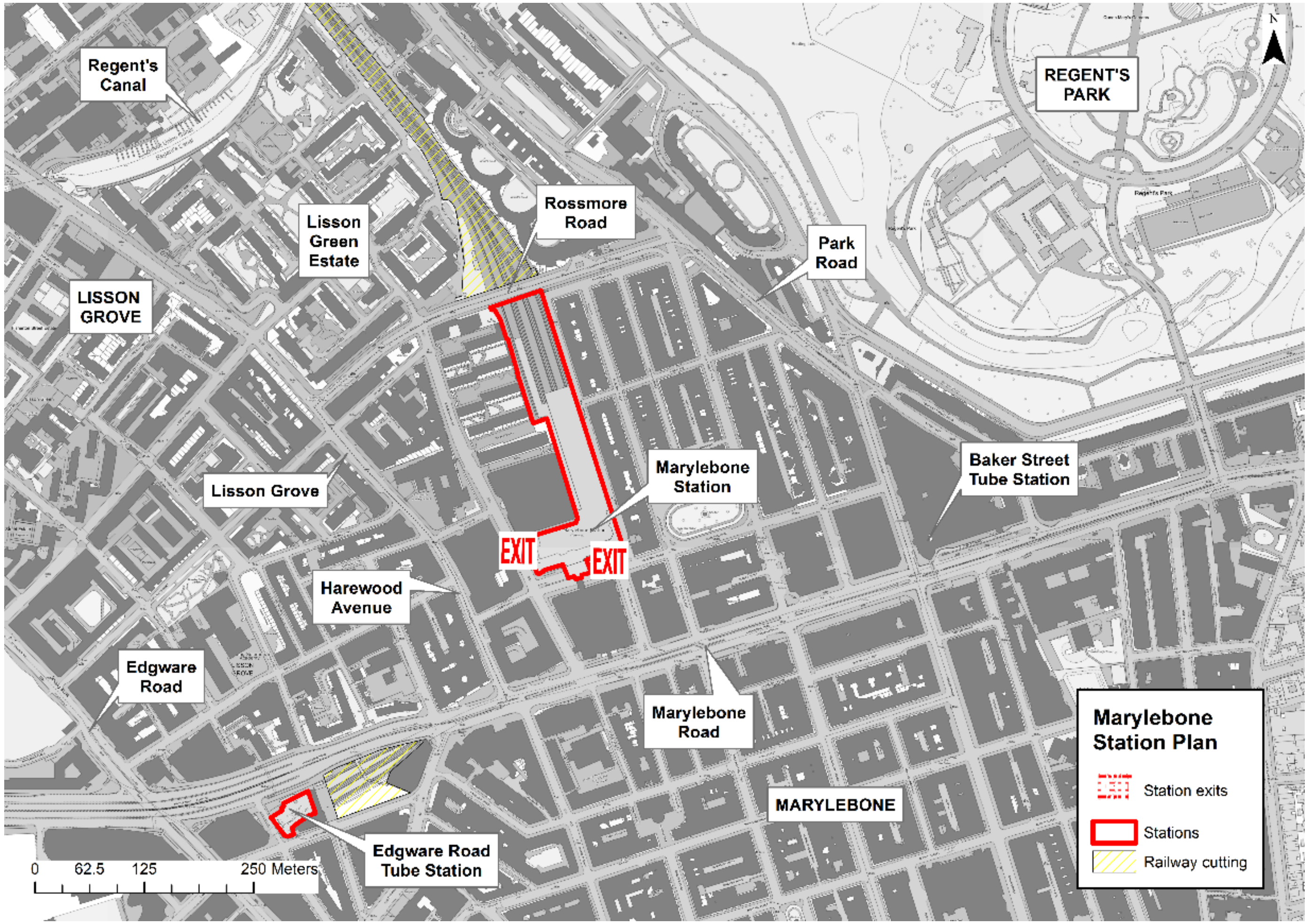

Figure 6.5: Marylebone Station plan 2014.

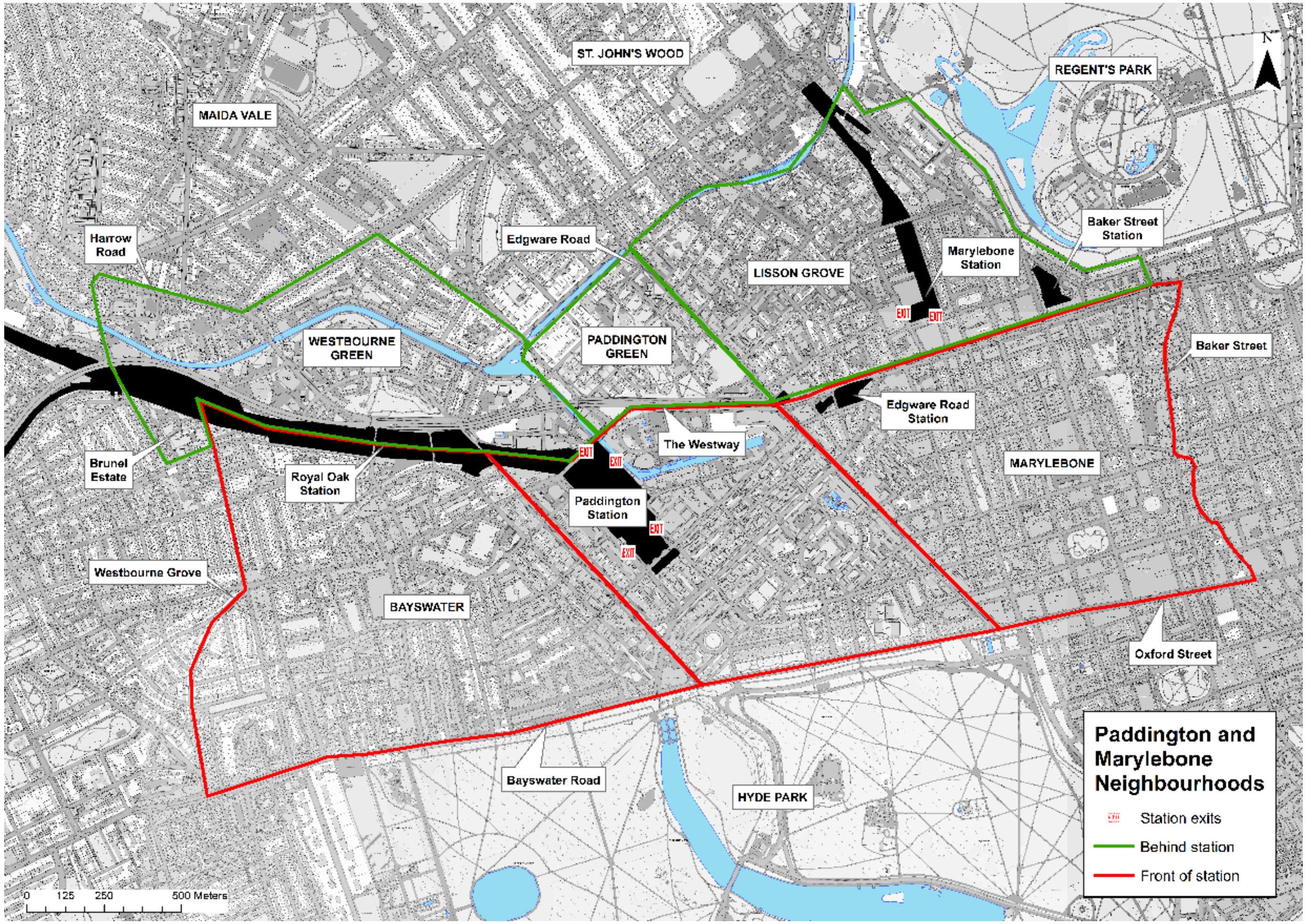

Figure 6.6: Paddington and Marylebone neighbourhood boundaries.

Block structure is analysed for the two stations in Figures 6.7 and 6.8 Streets south of both stations have retained their overall block structure since the 1880s to a much greater extent than those behind. The Marylebone neighbourhood was gradually built up during the eighteenth century as an extension to the newly fashionable West End, on land owned then by the Cavendish family, and now by the Howard de Walden Estate. Although blocks along Oxford Street and Edgware Road were extensively redeveloped during the later twentieth century for large stores (e.g. Selfridges, occupying an entire block) and offices, the overall block size has generally remained unchanged, retaining “a basic classical unity” (Nairn, 1966). Continuity also extends to the streets north of the Marylebone Road between the station and Regent's Park, where the early nineteenth century block size is also intact.

Several areas of Paddington were cleared for housing improvements, particularly after the Second World War when new developments such as the Tecton-designed Hallfield Estate (1947) were built. However, such estates have been inserted into a structure still clearly recognisable as the layout of Tyburnia, with much of the original Regency architecture still in place. The terraces of Bayswater lost their appeal when large domestic establishments became less fashionable and affordable after the First World War, and by the 1960s they offered cheap lodgings popular with people who were culturally and financially on the margins of society (Russell, 1960). However, the fortunes of the area recovered, and the twenty-first century has seen the neighbourhoods between Paddington and Hyde Park return to something closer to their nineteenth century social status.

The contrast between the neighbourhoods facing the two stations and those behind is sharp. The nineteenth century terraces of Westbourne Green were almost entirely demolished by the London County Council and the Greater London Council during the 1960s and replaced with a variety of housing types, from maisonettes to the towers and slab blocks of the Brindley and Warwick Estates. Paddington Green received the same treatment, with clearances for new LCC flats during the 1950s, and later the Paddington Green Estate, its towers completed in 1969. The location of these estates is shown in Figure 6.8.

Both areas are dominated by the elevated Westway, built between 1964 and 1970. Its construction required extensive demolition along its route, and has resulted in an undercroft space filled with traffic lanes and fencing, which forms visual and physical barriers across the Paddington area. This barrier combines with the adjacent mainline railway cutting to divide Paddington Green from Paddington and Bayswater, separating neighbourhoods behind and in front of the station. Access from one to the other is only possible by crossing first over the railway, then beneath the flyover, and in some places also over the Grand Junction canal.

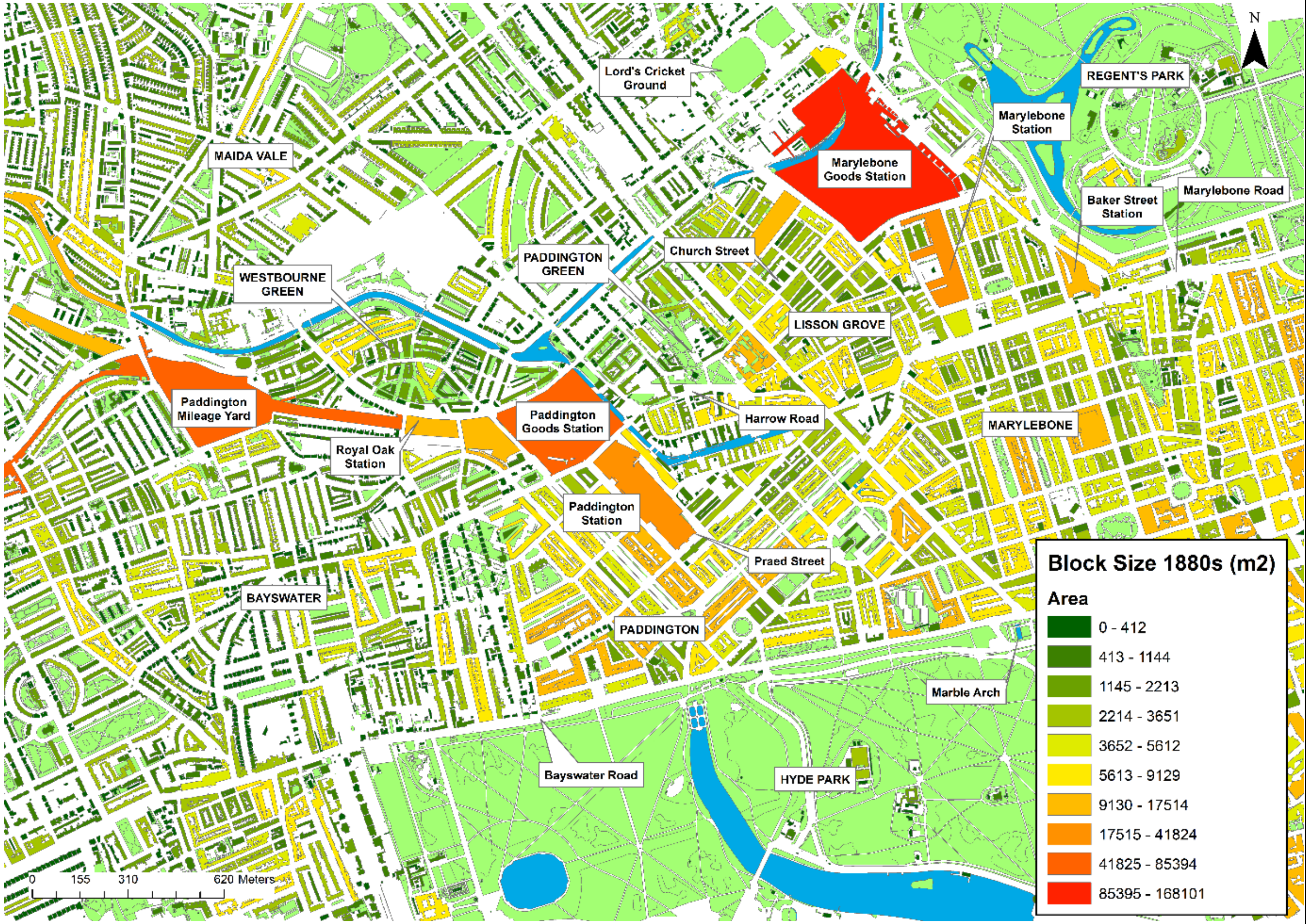

Figure 6.7: Paddington and Marylebone block size, 1880s.

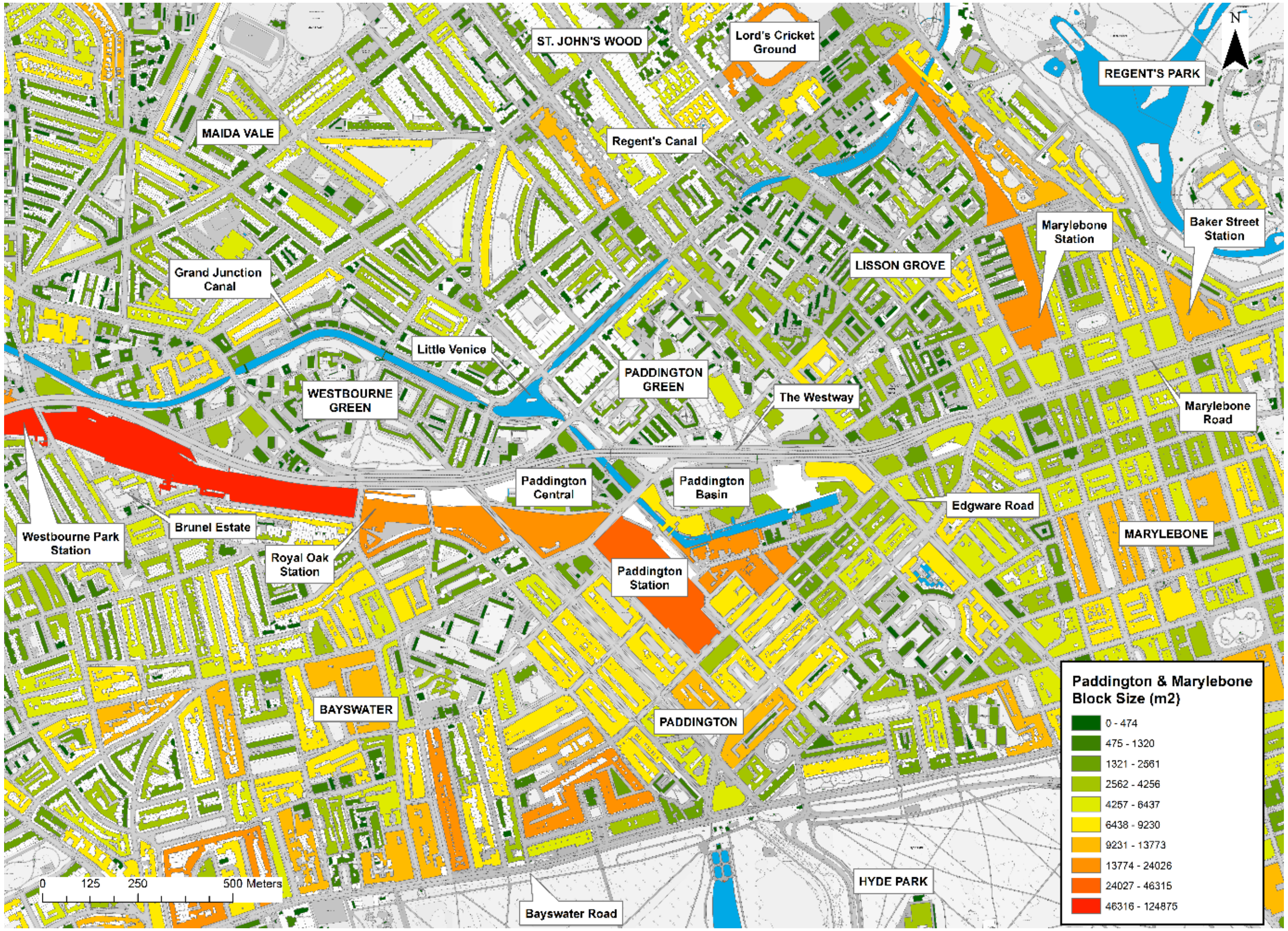

Figure 6.8: Paddington and Marylebone block size, 2010s.

Image 6.3: Harrow Road behind Paddington.

The construction of the Westway also resulted in the destruction of what had been Paddington's high street, the section of Harrow Road between Paddington Basin and Paddington Green (Image 6.3). Paddington Town Hall, headquarters of the Borough of Paddington before its 1965 abolition, was demolished along with nearly all the nineteenth century buildings and the street was realigned alongside the new flyover. At the time of writing, the last surviving block of pre-twentieth century buildings on this part of Harrow Road is being demolished.

There has also been transformative change behind Marylebone. Immediately behind the station the area occupied by the Goods Station (Figure 6.3) was built over for the Lisson Green Estate during the 1970s. The Church Street area, between Lisson Grove and Edgware Road, has also been significantly rebuilt with a complex combination of mid-twentieth century flats, 1970s slab blocks and 1980s low rise housing, all of which coexist with remaining elements of nineteenth century building stock.

Today the largest buildings in the wider area are Paddington Station (41,824 square metres) and Marylebone Station (20,132 square metres). Even though the latter is a small station, it is still a very large building in the context of inner London. The largest single block, larger than either station, is formed by the section of the Paddington approaches between

Westbourne Park and Royal Oak, with other large sections nearer the station. However, the stations were dwarfed by the size of their now demolished goods facilities: Paddington Goods Station and sidings covered 73,192m², and Marylebone Goods Station 182,588m² at its most extensive.

Figure 9 shows a frequency distribution analysis of blocks sizes in the 1880s and in the 2010s, calculated from the maps above. The neighbourhoods behind Paddington and Marylebone stations are separated from those in front, to allow comparison. The boundaries used for these two areas are illustrated below (Figure 6), and the rationale for their selection is explained.

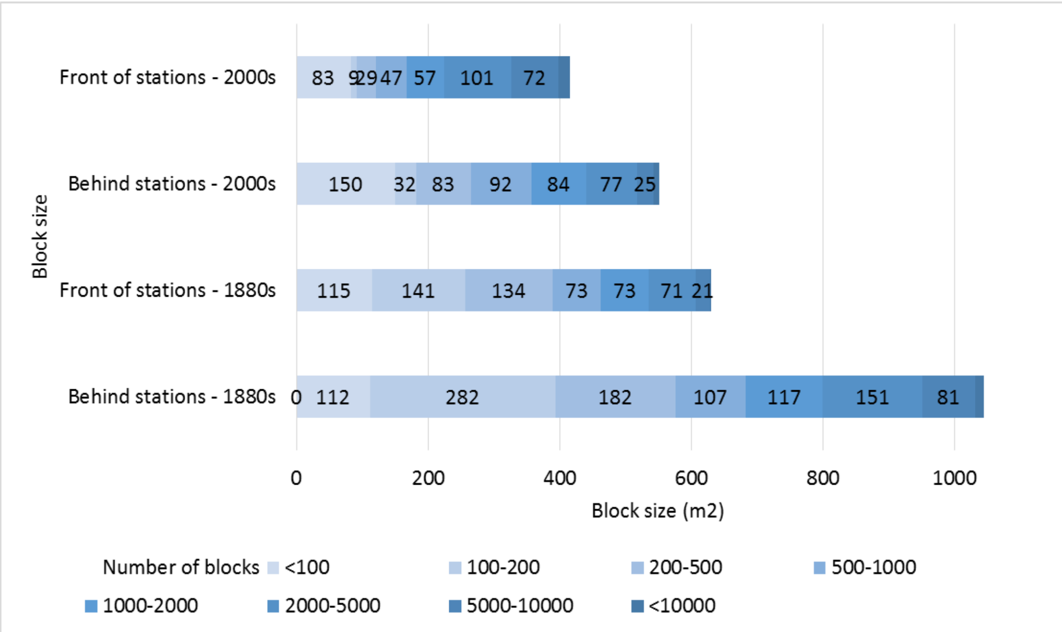

Figure 6.9: Frequency distribution of blocks by size, Paddington and Marylebone, 1880s and 2010s.

The number of blocks in both areas has fallen considerably since the 1880s, but more so behind the stations. The total in front dropped from 628 to 416 (34 per cent less) between the two periods, but behind the stations it fell from 1045 to 552 (47 per cent less). This reflects relative stability in the older, established neighbourhoods of Marylebone, Paddington and Bayswater. Behind the stations, the dense blocks of terraces in Westbourne Green, Paddington Green and Lisson Grove have been substantially replaced by a sparser morphology.

The distribution shows different size profiles between the two areas in both during both periods. Blocks in front of the stations tend to be larger, with more blocks between 2000m² and 5000m². Behind the stations, there are more blocks in the mid ranges, from 500m² -

$1000m^2$ and particularly in the smallest size range, with nearly twice as many blocks as in front of the stations. In the 1880s there were 464 blocks of $100m^2$ - $500m^2$ behind stations; in the 2010s there were 275 (47 per cent less). In front of the stations, block sizes have increased, with 111 blocks of more than 2000 square metres in the 1880s and 191 by the 2010s (72 per cent more).

These changes reflect a clear contrast in morphology between the front and the back of both stations. Larger, more regular blocks are found in Paddington, Marylebone and Bayswater where the planned nineteenth century grids largely remain. Behind the stations, the townscape is fragmented, and stand-alone estate blocks predominate.

Spatial analysis

Network change

Overlaying the street networks around the stations for the 1880s and 2010s shows that, while the street pattern has remained relatively stable, the most substantial changes have taken place behind Paddington and Marylebone Stations. Neighbourhoods facing the stations are structurally substantially unaltered between the two periods, their basic grid structure remaining intact. By contrast, Westbourne Green, Paddington Green and Lisson Grove have been largely reconstructed during the same period. The large-scale replacement of nineteenth century housing in these areas with post-war social housing estates involved the introduction of new street layouts, which dismantled existing grids in order to separate traffic from pedestrians.

	Total number of segments	Mean segment length (m)	Dead ends as percentage of total segments
Station front areas			
Bayswater / Paddington / Marylebone 1880s	1607	59	1.7%
Bayswater / Paddington / Marylebone 2010s	1049	59	2.7%
Percentage change	**-35%**	**-1%**	N/A
Station back areas			
Westbourne Park / Paddington Green / Lisson Grove 1880s	1154	56	2.6%
Westbourne Park / Paddington Green / Lisson Grove 2010s	796	68	4.8%
Percentage change	**-31%**	**21%**	**N/A**

Table 6.1: Street network data, Paddington and Marylebone, 1880s and the 2010s.[47]

[47] Lower value of the two time periods shown in red, for ease of comparison.

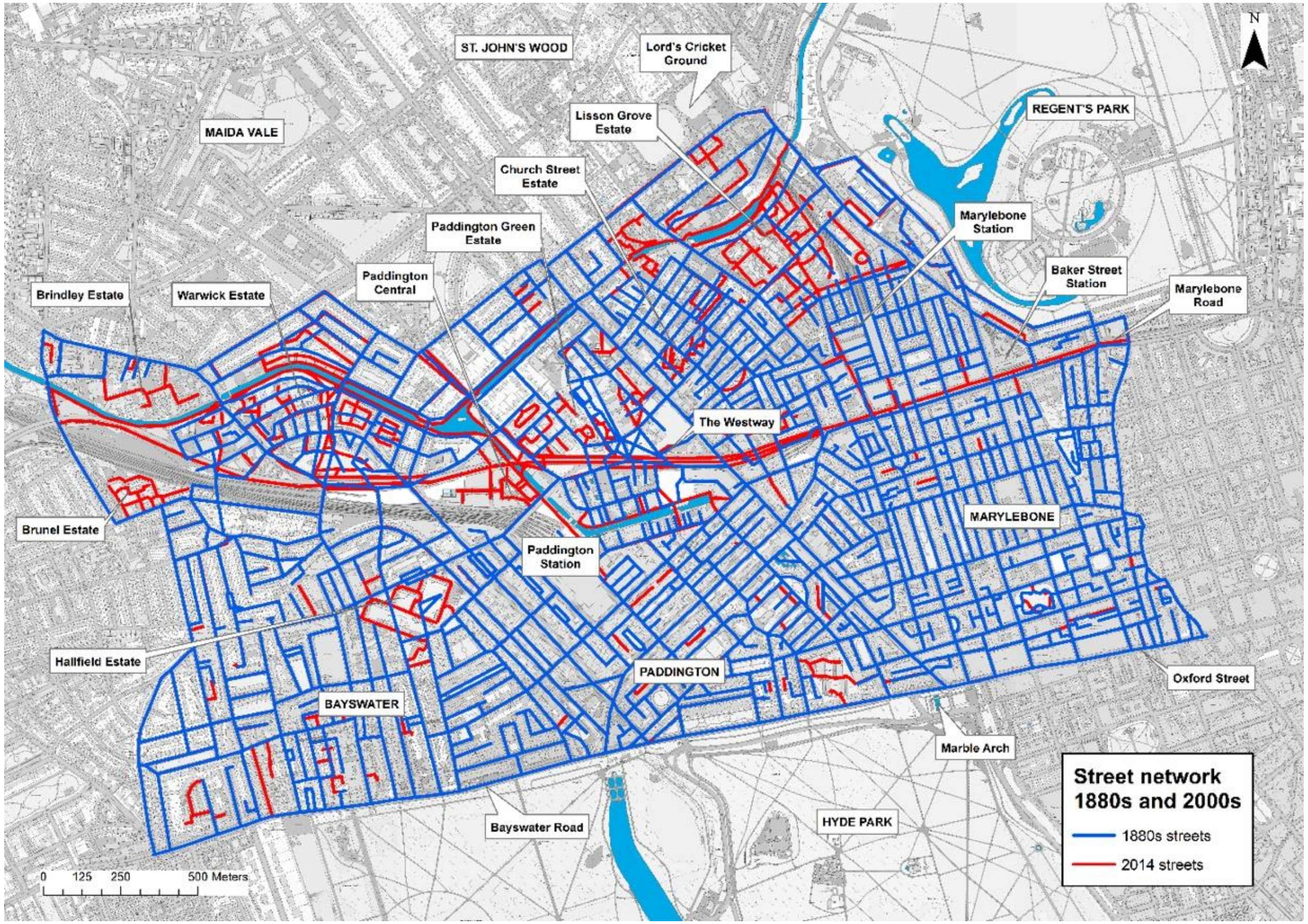

Figure 6.10: Paddington and Marylebone streets 1880s and 2010s.

Total segment numbers have decreased by more than 30 per cent in neighbourhoods both in front and behind the two stations. Behind the stations, clearances for the construction of Marylebone Station and large-scale housing reconstruction account for the scale of this change. In areas facing the station the scale of the reduction in segment numbers is more surprising. It is partly accounted for by the disappearance in the intervening period of many of the small alleys which penetrated the evenly sized blocks found in much of Bayswater, Paddington and Marylebone. During the twentieth century these were substantially closed off or built over, and single, large buildings replaced blocks which in the nineteenth century contained many small business and workshops. Areas of the street network have also been simplified, such as Paddington Basin where the wharves with their numerous short access roads have been replaced by a single, canal-side route.

However, while mean segment length has remained unchanged in Bayswater, Paddington and Marylebone it has increased by more than 20 per cent behind the stations. The percentage of dead ends has also increased, forming nearly twice as large a proportion of the street network behind the stations than in front. In Westbourne Green, Paddington Green and Lisson Grove a different process of change can be seen at work between the two study periods, resulting in a clear spatial contrast between areas behind the station and those in front. Housing estates, built between the 1940s and the 1970s either on ex-railway land or in areas closely defined by rail, road and canal infrastructure, account for most of the concentrated areas of reconfiguration highlighted in Figure 6.8. Increases in segment length and proportion of dead ends between the two time periods reflects the change in housing type from terraces to stand-alone blocks.

Space syntax analysis

Segment maps showing Choice at 3000m for the two time periods, shown in Figures 6.11 and 6.12, highlight the same structure of main, through routes during each period. Two main routes traverse the whole area from east to west. Bayswater Road, the northern boundary of Hyde Park, is a section of London's main east-west route, becoming Oxford Street to the east and Notting Hill Gate to the west. It has some of the highest Choice values in the city. Marylebone Road (A501) was originally the New Road, "the world's first bypass" (Nairn, 1966) when it was built in 1756 to skirt the northern edge of London, and it remains both a high Choice through route and a bypass. To the east it becomes Euston Road; to the west the main alteration between the two maps is introduction of the elevated Westway now carrying the A501 along an elevated route beside the railway.

	Choice 3000m	Choice 800m	Choice 400m
Station front areas			
Bayswater / Paddington / Marylebone 1880s	587374543	11366727	1824390
Bayswater / Paddington / Marylebone 2010s	415271023	10805064	1410749
Percentage change	**-29%**	**-5%**	**-23%**
Station back areas			
Westbourne Park / Paddington Green / Lisson Grove 1880s	342296183	10025316	1342286
Westbourne Park / Paddington Green / Lisson Grove 2010s	426771808	8528478	1066299
Percentage change	**25%**	**-15%**	**-21%**

Table 6.2: Mean Choice values for Paddington and Marylebone, 1880s and 2010s.[48]

The only single road that crosses the whole area from north to south is Edgware Road (A5), another very high Choice route. The junction between the A5 and the A501 is halfway between Paddington and Marylebone Stations, making the area a combined entrance point to London for road, as well as rail transport. Lisson Grove, passing the western side of Marylebone Station, has higher Choice values than surrounding routes and is the main route through the neighbourhoods behind and to the west of the station. Higher Choice routes behind Paddington, such as Harrow Road, connect to the few crossing points over the tracks.

[48] Lower value of the two time periods shown in red, for ease of comparison.

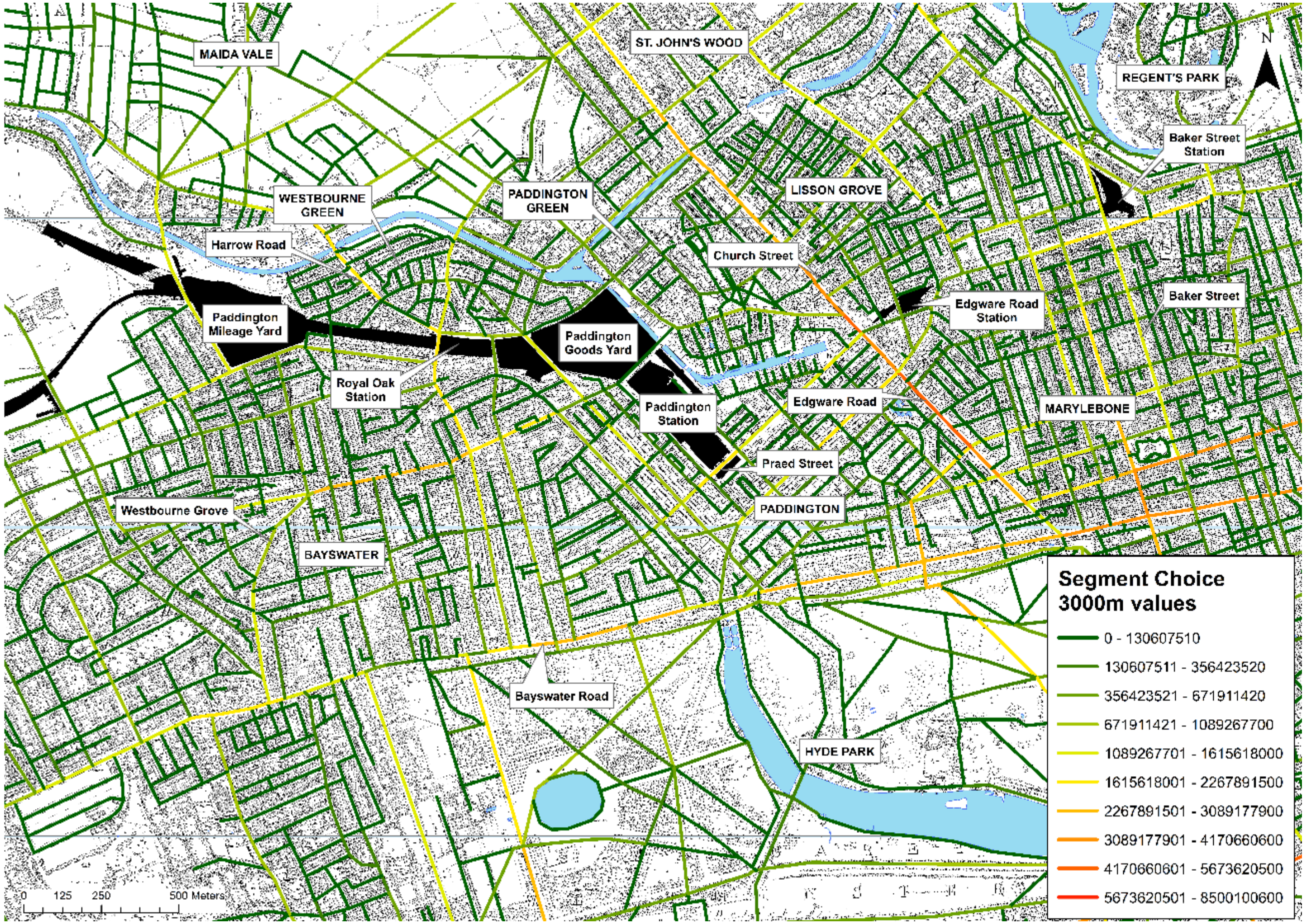

Figure 6.11: Choice 3000m, Paddington and Marylebone 1880s.

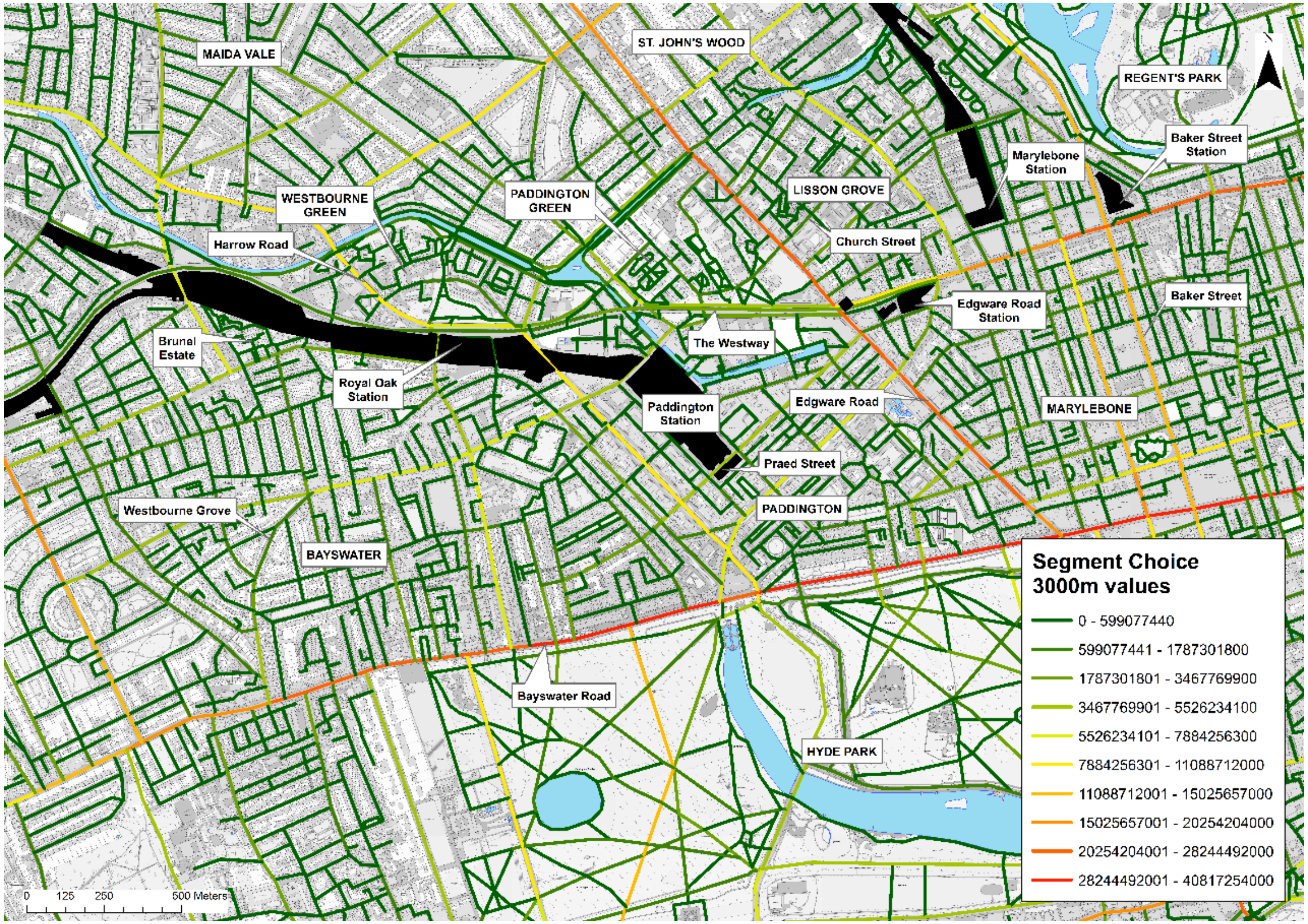

Figure 6.12: Choice 3000m, Paddington and Marylebone 2014.

In neighbourhoods facing the station global Choice has barely changed, while behind the station it has increased by a remarkable 25 per cent. This quantifies the spatial impact of reconfiguring the area as a focus for through routes; the introduction of the Westway in particular explains the scale of this change. At the larger scale of 3000m, the same contrast is seen between the two areas, with a fall in Choice values in front of the station mirroring the rise behind. As the scale reduces, the differences disappear until at 400m the scale of change is the same behind and in front of the stations. It seems that neighbourhoods across both areas have become less well connected at very local level, but that the all the neighbourhoods behind the stations have developed new roles as through routes for London – extending the logic introduced with the world's first bypass.

Integration measured at 800m for the wider Paddington and Marylebone area in Figures 6.13 and 6.14 highlights the Marylebone grid, south of Marylebone Road, as the highly integrated core of the area in both time periods. It forms the western portion of the wider West End, where similar highly Integration streets grids are consistently found. Marylebone has been part of what would now be termed London's Central Activities Zone since its construction in the eighteenth century. The majority of streets in the neighbourhood, not just larger roads, are highly accessible in equivalent of an average 10 minute walk.

Both maps also show a clear separation between the integrated West End core and surrounding areas, with streets west of Edgware Road and north of Marylebone Road much less integrated at 800m. Higher Integration values are concentrated along main roads, falling the greater the distance from them. Islands of low Integration segments are apparent in the 1880s behind Paddington Station in Westbourne Green, in parts of Paddington Green and around Paddington Basin. The streets which, within ten years of the 1880s maps, were demolished for Marylebone Station form an area of low Integration with by Regent's Park to the east and the Regent's Canal to the north.

By 2014 these poorly integrated islands have become more noticeable and extensive, spreading from their previous locations to encompass the entire neighbourhoods of Westbourne Green, Paddington Green (Image 6.4) and much of Lisson Grove. They also include all the areas of redeveloped railway land behind both stations: the Lisson Grove Estate, built on the Marylebone Goods Station; the Brunel Estate on the Mileage Yard; and the Paddington Central development on the Paddington Goods Station. In front of the stations, areas of low Integration are smaller and more isolated, found where post-war estates were inserted into the street grid.

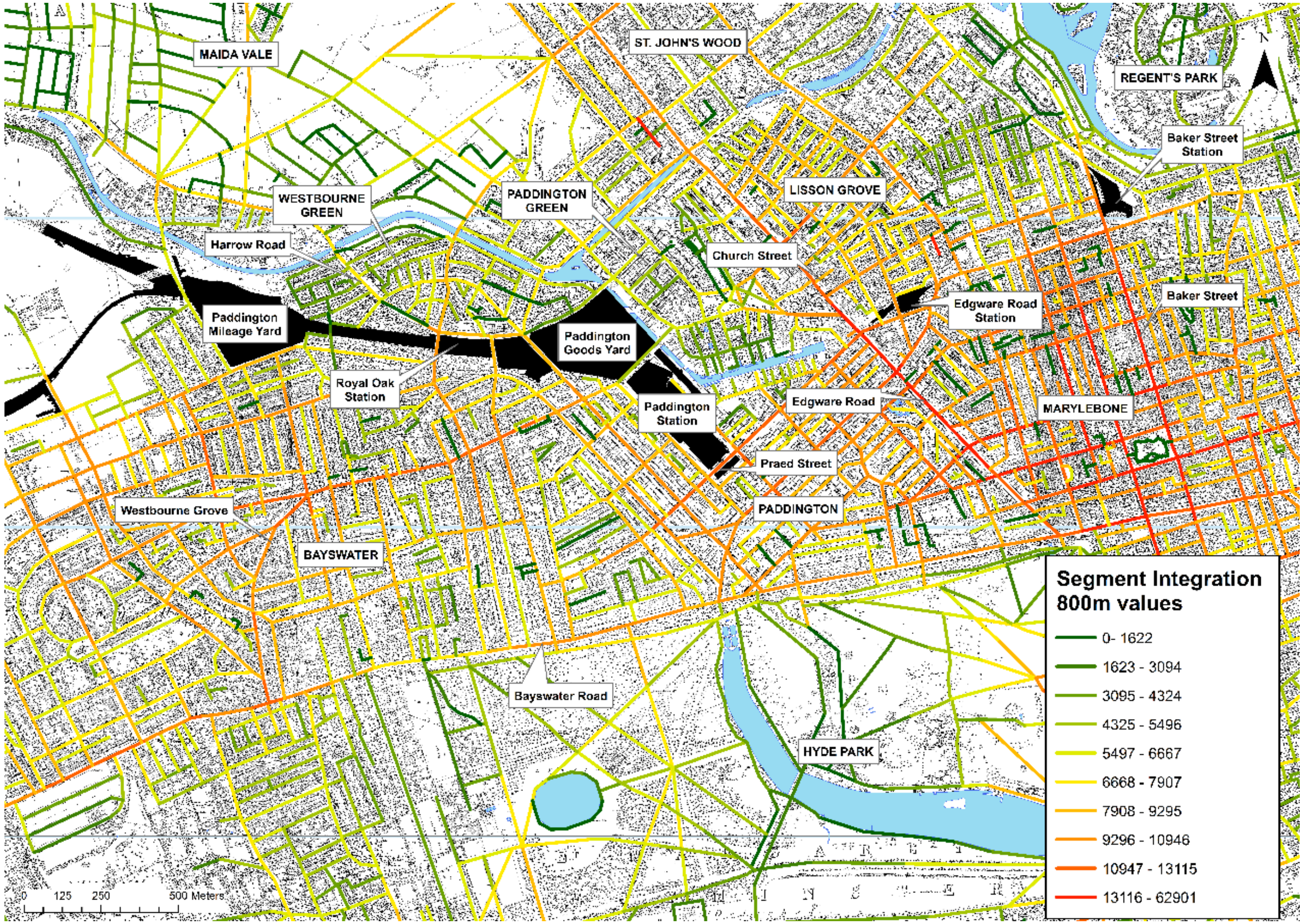

Figure 6.13: Integration 800m, Paddington and Marylebone 1880s.

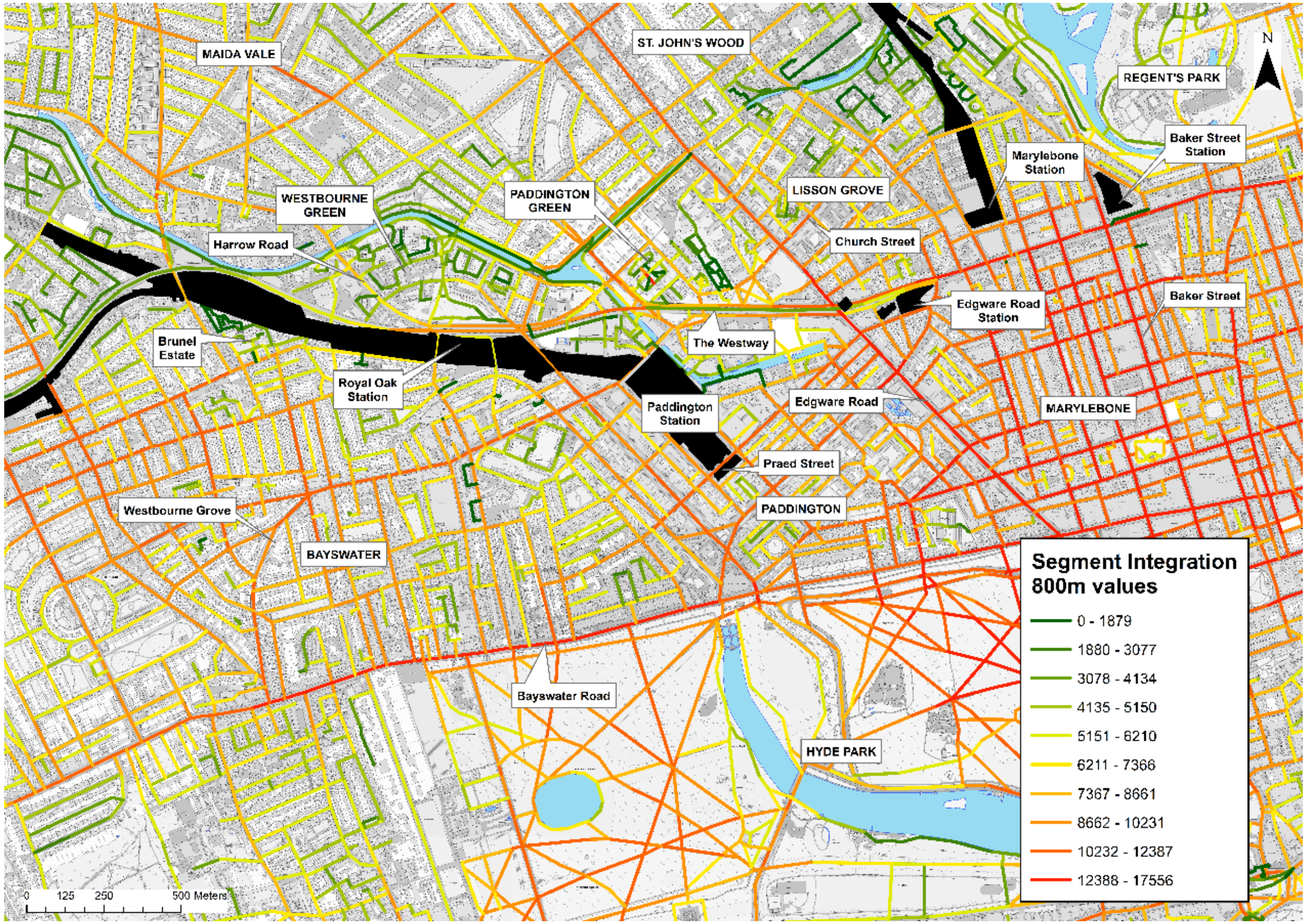

Figure 6.14: Integration 800m, Paddington and Marylebone 2014.

Image 6.4: Paddington Green Estate.

It is also apparent that, where the Marylebone grid extends into adjacent neighbourhoods, Integration values are higher than in surrounding streets. The portion of the street grid that survives to the east of Marylebone Station, the grid south of Church Street and the streets of Paddington/Tyburnia all form extensions of the locally integrated West End. One of the most obvious changes between the two maps is the erosion of this extended grid, which has disappeared north of Church Street, in Paddington Green and in Westbourne Park, resulting in greatly reduced Integration values. The replacement of the Harrow Road behind Paddington by the Westway has removed the integrated main route which provided a centre for Paddington Green next to the station, meaning that the only well-integrated streets near the station are all now to the south, whereas the station once had a high street to the north as well.

Table 6.3 shows changes in Integration at 800m across both periods for neighbourhoods facing the stations and for those behind. Integration values have changed little at global scale. At 3000m they have fallen in front of the station and increased behind; at smaller scales values have fallen further behind the stations than they have in front. This pattern suggests that neighbourhoods behind have become more integrated as destinations for longer journeys from further afield, although overall values remain lower than those in front.

For local journeys, those at scales within the boundaries of the study area, the likelihood of journeys to segments in neighbourhoods behind the stations has reduced to a disproportionate extent since the 1880s. This figures demonstrate the effect of the spreading areas of lower Integration apparent in Figure 6.14

	Integration 3000m	**Integration 800m**	**Integration 400m**
Station front areas			
Bayswater / Paddington / Marylebone 1880s	52340	8604	3207
Bayswater / Paddington / Marylebone 2010s	49456	8136	2888
Percentage change	**-5%**	**-5%**	**-8%**
Station back areas			
Westbourne Park / Paddington Green / Lisson Grove 1880s	43631	6748	2606
Westbourne Park / Paddington Green / Lisson Grove 2010s	47522	6024	2224
Percentage change	**9%**	**-11%**	**-15%**

Table 6.3: Mean Integration values, Paddington and Marylebone, 1880s and 2010s.[49]

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[49] Lower value of the two time periods shown in red, for ease of comparison.

Land use analysis

Figures 6.15 and 6.16 display retail premises only. As the figures in Table 6.4 show, retail was the largest single group of land uses after residential. As the maps show, shops were clustered on particular streets.

Figure 6.15 shows that during the 1880s, shops in the Paddington neighbourhoods were generally restricted to particular locations. Bayswater had two major shopping streets – Queensway and Westbourne Grove – and the remaining streets were mostly residential. Shops were found close to Paddington Station, especially along Praed Street immediately in front of the station. Shops in Westbourne Green were on Harrow Road, but also in nearby back streets. There were also clusters of shops further east along Harrow Road, where it passes through Paddington Green. Figure 6.16 shows a more even spread of retail across both Marylebone and Lisson Grove. While Edgware Road is the main shopping axis for the area, there were also shops clustered on Baker Street, Crawford Street and Marylebone Lane. However, Lisson Grove had a much wider distribution of retail, with shops found on the majority of streets. While some well-integrated streets in Marylebone were mostly residential, only the lowest Integration segments in Lisson Grove lacked retail. By contrast, the adjacent streets and squares later demolished for Marylebone Station were poorly integrated and lacked retail premises.

The distribution of shops in these areas had changed significantly by the 2010s, but only in areas behind the stations. As Figure 6.17 shows, the patterns of retail in Bayswater, Paddington and Marylebone remain very similar, with the same primary shopping streets found in the same locations. However, the more even distribution of retail in Westbourne Green, Paddington Green and Lisson Grove has disappeared. Shops in Westbourne Green are now restricted to Harrow Road, where nineteenth century shops remain. Paddington Green has almost no shops at all, with the local centre on Harrow Road replaced by the Westway.

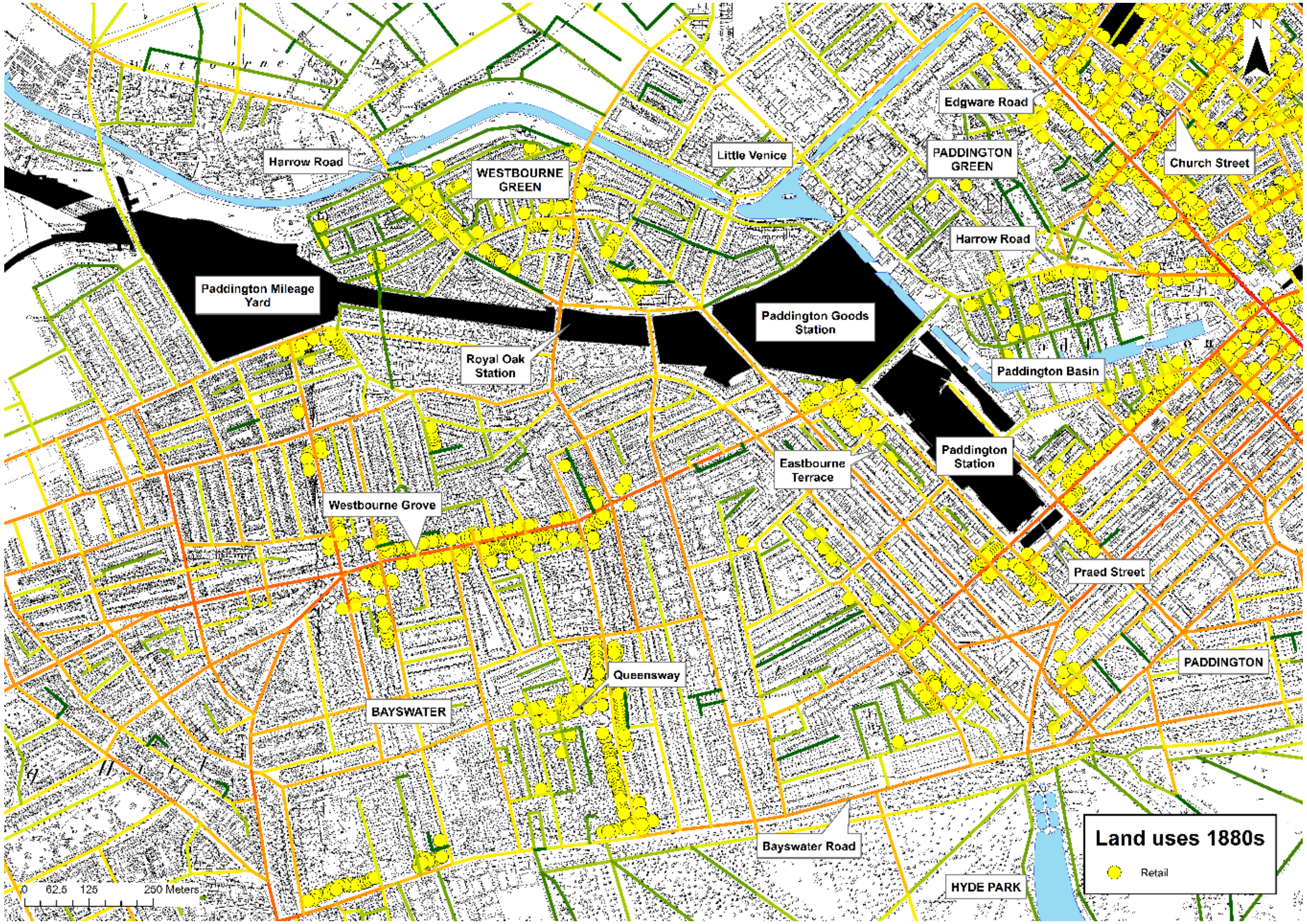

Figure 6.15: Paddington: retail 1880s, Integration 800m.

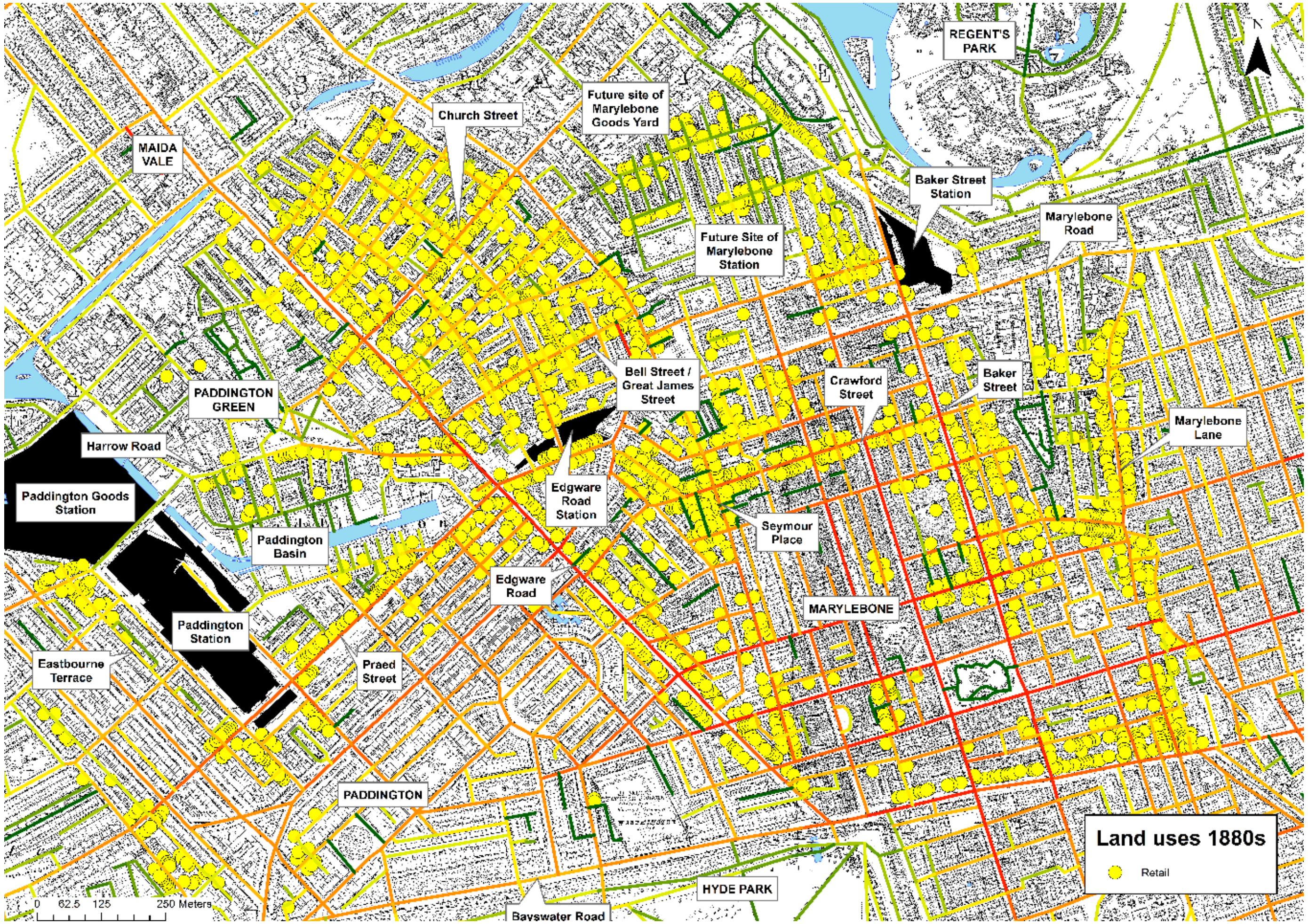

Figure 6.16: Marylebone: retail 1880s, Integration 800m.

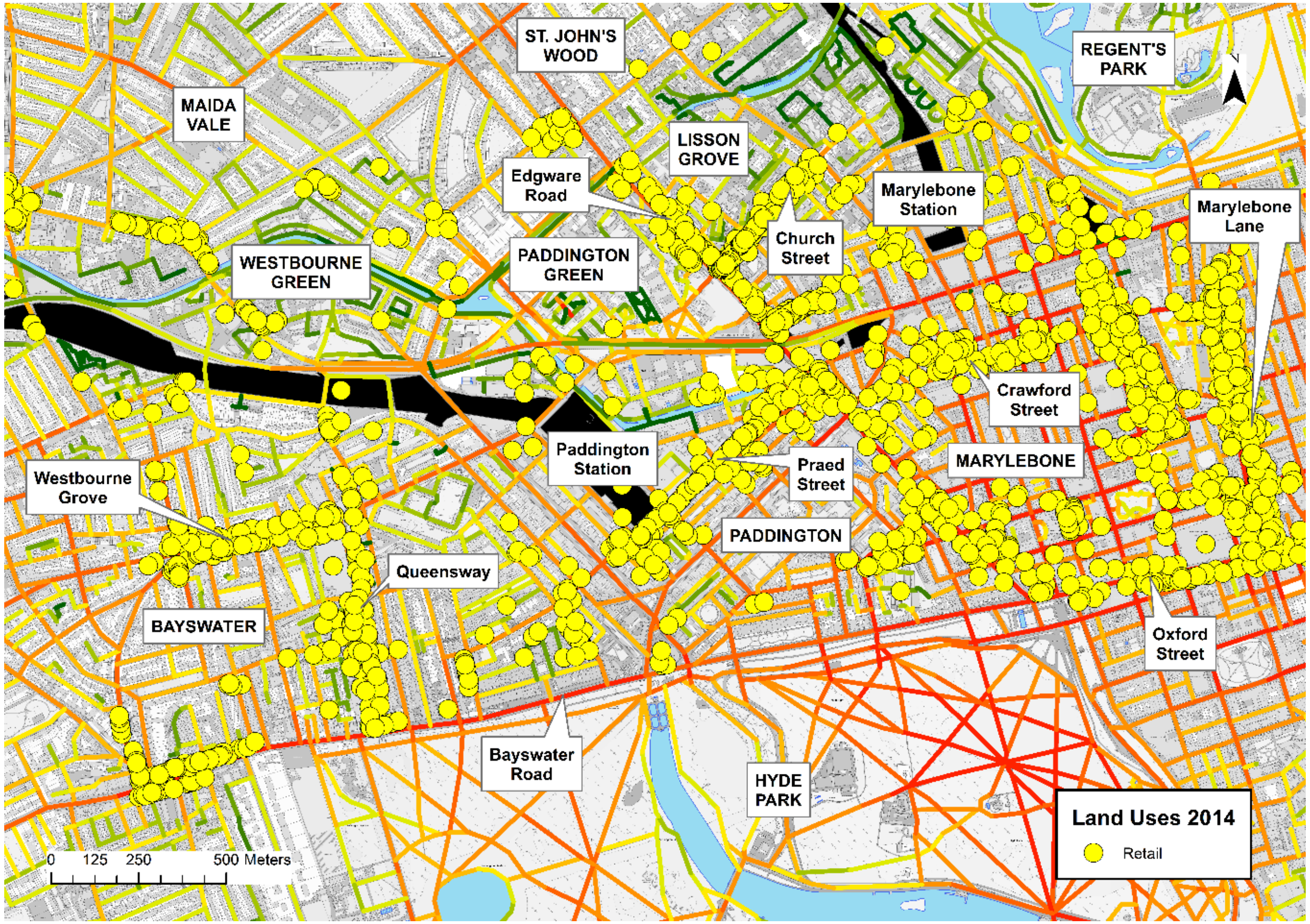

Figure 6.17: Paddington and Marylebone: retail 2014, Integration 800m.

Image 6.5: Church Street Market.

In Lisson Grove shops are still to be found, but only on two streets other than Edgware Road. North of Church Street, which remains a shopping and market street, the street grid has been reconfigured and there are now no shops. Much of this area was cleared for Marylebone Goods Station, and subsequently redeveloped with housing estates. The grid south of Church Street was also substantially remodelled, but there are shops still concentrated on part of Bell Street. Retailers are no longer distributed across the whole neighbourhood, as they were in the 1880s. The remnants of the street grid in Lisson Grove have retained their Integration values and their central functions, a role established before the arrival of the station, in contrast to the areas with lower Integration values further behind the station to the north. Church Street is a long-standing market street also characterised by a large number of small, independent business in permanent premises. These are predominantly Middle Eastern, and therefore likely to thrive on a specialised, locally based clientele.

Figures 6.18 and 6.19 show accommodation only. This is a land use that might be expected to have a closer association with stations than any other, with travellers most likely to be customers for hotel rooms. The pattern of distribution here was clear, and almost all the hotels in the area were located in front of the two stations.

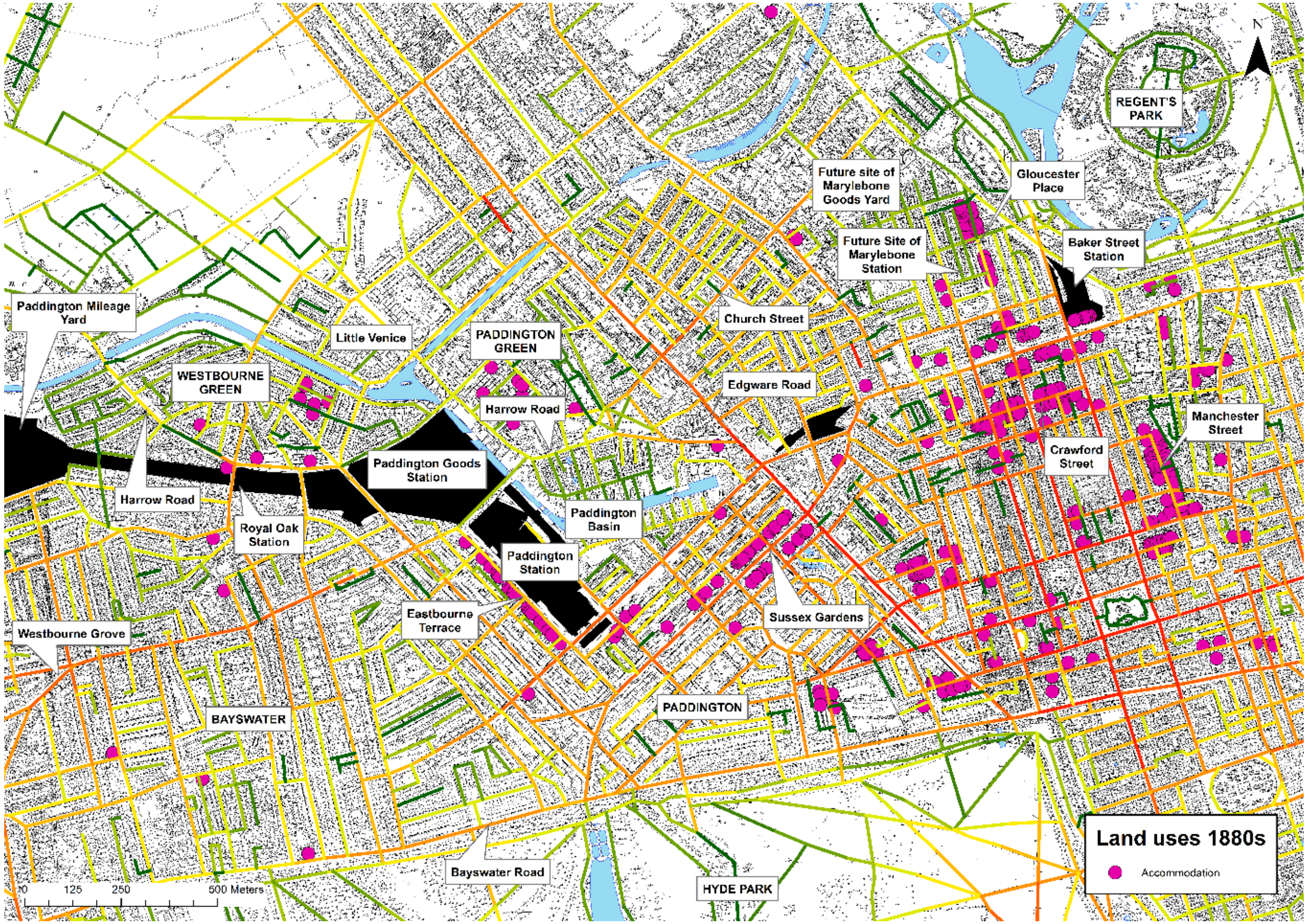

Figure 6.18: Paddington and Marylebone: accommodation 1880s, Integration 800m.

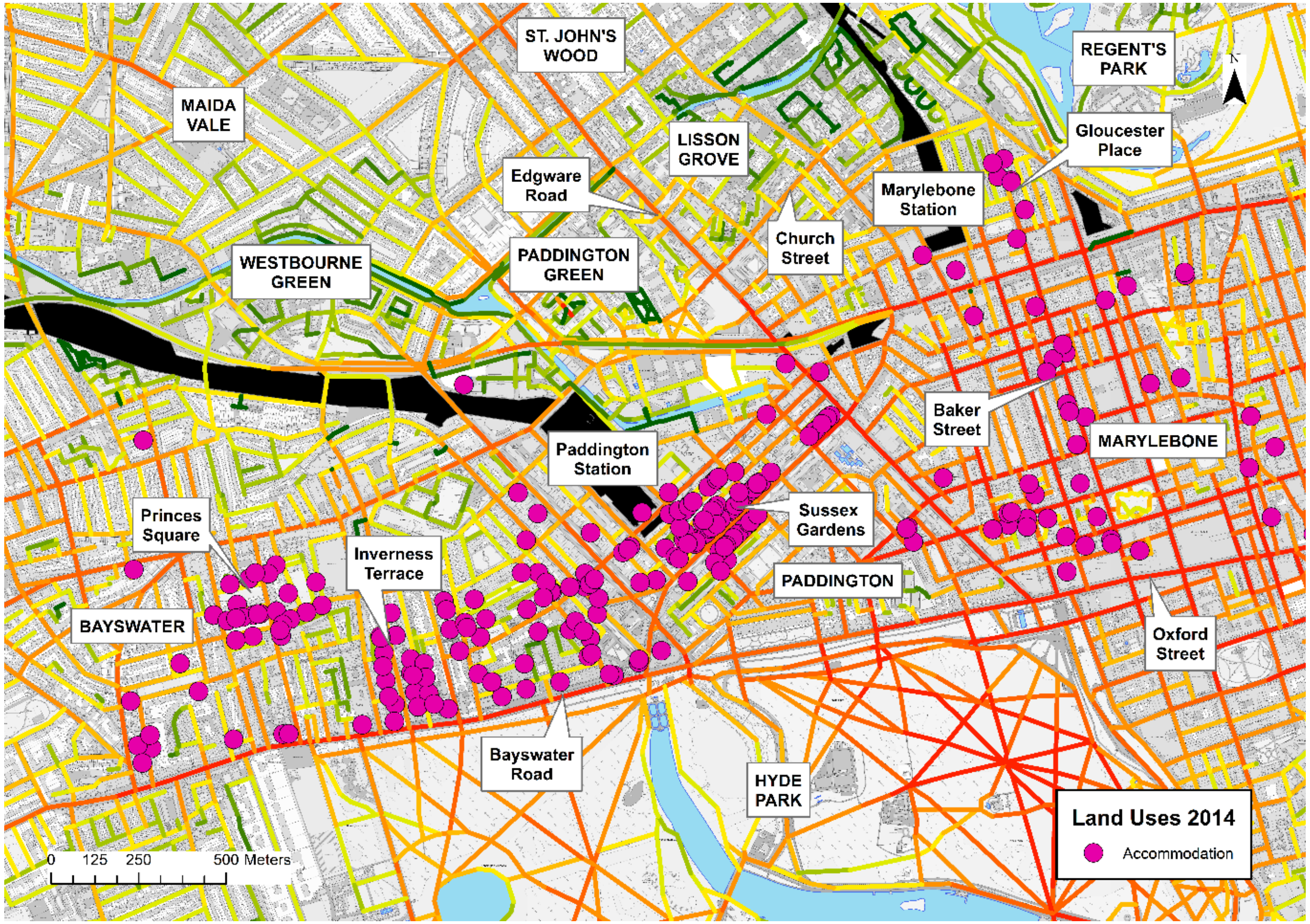

Figure 6.19: Paddington and Marylebone: accommodation 2014, Integration 800m.

Figure 6.18 shows that in the 1880s accommodation was found in a limited number of streets close to the front of Paddington Station – Eastbourne Terrace and Sussex Gardens. In Marylebone, hotels and lodging houses are also focused along particular streets – Crawford Street and Manchester Street – but are also found around Gloucester Place, next to the site of Marylebone Station. Hotels are located in streets close to those preferred by retail, but often a block away, for example Sussex Gardens in Paddington which is one street further away from the station than Praed Street, where shops are found. The distribution of accommodation marks a very clear divide in function and character between neighbourhoods to the north and south of the two stations.

By the 2010s, as Figure 6.19 shows, this pattern had intensified. Today there are no hotels behind Paddington Station, and they are all to be found in front, the majority still on Sussex Gardens. Likewise, the small number of lodging houses previously to be found around the Marylebone site have disappeared. Since the construction of the station, a clear difference has emerged between front and back areas. Hotels are still found on Gloucester Place, but there are no longer any in Lisson Grove. A logical pattern has emerged in which uses likely to appeal to travellers are found in areas that they frequent. They are not expected in the low Integration islands of Westbourne Green, Paddington Green or Lisson Grove.

	Mean Choice 3000m	Mean Integration 800m
1880s front of stations	350876608	8498
2010s front of stations	427775517	7811
Percentage change	**22%**	**-8%**
1880s behind stations	364963673	6635
2010s behind stations	432402764	4778
Percentage change	**18%**	**-28%**

Table 6.4: Paddington and Marylebone non-residential land use values, 1880s and 2010s.[50]

When non-residential land uses are linked to the spatial values for their closest segment, the results give insight into similarities and differences either side of these stations. Mean Choice 3000m values for these land uses have increased both in front of and behind the stations by a similar percentage.

[50] Lower value of the two time periods shown in red, for ease of comparison.

Land use		Count
Accommodation	**1880s front**	296
	2010s front	260
	1880s behind	71
	2010s behind	13
Eating	**1880s front**	66
	2010s front	379
	1880s behind	39
	2010s behind	76
Industrial	**1880s front**	80
	2010s front	53
	1880s behind	102
	2010s behind	137
Offices	**1880s front**	71
	2010s front	1277
	1880s behind	22
	2010s behind	344
Public houses	**1880s front**	155
	2010s front	67
	1880s behind	105
	2010s behind	18
Retail	**1880s front**	1767
	2010s front	1897
	1880s behind	1140
	2010s behind	821
Services	**1880s front**	560
	2010s front	1912
	1880s behind	356
	2010s behind	429

Table 6.5: Paddington and Marylebone non-residential land use count, 1880s and 2010s.[51]

[51] Lower value of the two time periods shown in red, for ease of comparison.

However, Integration 800m values have fallen by 28 per cent behind the stations, as opposed to only 8 per cent in front. Taken together these trends suggest a disproportionate loss of integrated land uses in areas behind Paddington and Marylebone, compared with areas in front. Meanwhile, non-residential land uses are more likely to be found on longer, higher Choice and higher Integration routes, on average, in front areas.

Changes in the land uses between the two time periods show a substantial thinning out of non-residential uses behind the stations. In front of the stations all categories have increased in numbers, apart from a small reduction in accommodation. Behind the stations, accommodation has reduced by 82 per cent; the number of shops by 39 per cent; and the number of pubs by 83 per cent. There have also been increases: the number of industrial premises by 34 per cent per cent; offices by 1,464 per cent; eating places by 95 per cent; and services by 21 per cent.

Some of these trends can be attributed to changes in working and living patterns, and are also found in front of the stations, including the rise of the restaurant, the twenty-first century dominance of the office, and the long-term decline of the pub. However, the analysis demonstrates that neighbourhoods located behind the stations have lost a greater proportion of non-residential uses than those in front. In categories where use count has increased, they have done so by a lower factor than in front of the stations except for industrial uses, which are now found in greater numbers behind the station than in front.

Table 6.6 shows non-residential land use density for both areas and both eras. Figures show mean uses for each street segment, weighted by length; and the mean segment length between each land use.

These figures confirm the patterns suggested above. In front of the stations, density of non-residential uses has increased by 83 percent since the 1880s. The average distance between uses has also increased, by 12 per cent, as the street network densified (as shown in Figure 10). Behind the stations, use density has remained unchanged, but the mean distance between uses has increased by 53 per cent. These contrasting trends demonstrate the nature of the change that has occurred since the nineteenth century, with uses becoming sparser in Westbourne Green, Paddington Green and Lisson Grove while simultaneously intensifying in Bayswater, Paddington and Marylebone.

	Mean uses per segment (weighted by segment length)	Mean segment length per use (m)	Shannon Diversity Index
1880s front of stations	8	31	1.2
2010s front of stations	14	35	1.5
Percentage change	**83%**	**12%**	**33%**
1880s behind stations	4	26	0.7
2010s behind stations	4	40	0.0
Percentage change	**0%**	**53%**	**-99%**

Table 6.6: Paddington and Marylebone non-residential land use density, 1880s and 2010s.

The Shannon Diversity Index shows a comparable pattern of change between front and back areas. Land use diversity is higher in front areas and has increased by a third since the 1880s which, given reductions in central London diversity found in front areas at Euston, King's Cross and St. Pancras, suggests a notable level of change in front areas. These neighbourhoods have increased in both land use density and diversity since the nineteenth century, with activities such as retail and accommodation expanding beyond a few selected main streets into secondary streets, becoming more widespread across Bayswater and Paddington in particular.

While these front neighbourhoods have developed across the time period, land use diversity in station back areas has followed the opposite trajectory, with a substantial decrease in diversity. The Shannon Index figure has fallen to a point where it is too close to zero to be detectable at single decimal point resolution. This change shows a thinning in diversity alongside the fall in mean segment length per use. In Westbourne Green, Paddington Green and Lisson Grove, a complex, dense arrangement of uses has been replaced by a simplified version, with shops, accommodation and other uses only found on selected larger streets, as was previously the case in station front areas. Diversity in these neighbourhoods is much lower than in Bayswater, Marylebone and Paddington.

Social analysis

Social analysis has been carried out for the Paddington and Marylebone neighbourhoods, using separate methods for the late nineteenth century and for the early twenty-first century. Figure 6.20 shows the 1898 Booth map of the area.

The Booth map immediately reveals neighbourhoods around Paddington Station with very different social characteristics. The squares and avenues of Tyburnia are predominantly Yellow (Wealthy), the highest income bracket. They were part of a high value property band surrounding Hyde Park, extending west into Bayswater in the streets closest to the park and east into Marylebone, and Mayfair to the south. In fact, this band also includes the south side of Hyde Park, off this section of the map, where it is bordered by Belgravia (Chapter Nine: Discussion and Conclusions). These are still the wealthiest areas of central London, and have been so since their construction. Despite the size of its houses, Paddington/Tyburnia does not carry the same name recognition as Mayfair or Belgravia. It is a smaller area than either, but there is also evidence in Booth that the proximity of the station has influenced the fortunes of the neighbourhood.

South of Praed Street the Booth Survey identified highly respectable occupants, for example Norfolk Square which is occupied by "lawyers, barristers, well-to-do" (Booth, 1902, B355 p. 197). There were "no poor except in mews, and not any very poor in them" (Booth, 1902, B355 p. 249). The only change that Booth's researchers spotted in the social character of the area was "deterioration" in the mews streets. Ironically, this was also attributed to the presence of the railway: "Far fewer carriages kept now. Richer classes now travel freely by bus and rail" (Booth, 1902, B355 p. 223).

However, in the block surrounding Paddington to the front of the station, the Yellow disappeared and Red (Middle Class) was mixed with a variety of poorer classification. The streets were characterised by an uncontrollable problem with prostitution. The notebooks described "Brothels… many around Paddington. Vestry[52] was active at one time but has now ceased to prosecute because of the expense. Brothels now spring up at their own will. Large station convenient centre around which to congregate" (Booth, 1902, B355 p. 225). The notebooks identified further individual brothels: long-standing, well-known, and all located in streets close to the station.

[52] Vestry Boards were the predecessors of modern local authorities: an administrative office of a parish church, whose elected members were responsible for the provision of various local services. They were abolished in the County of London by the Local Government Act of 1899, replaced by the London Boroughs.

Figure 6.20: Paddington and Marylebone 1898, Charles Booth Survey map. [53]

[53] Source: Charles Booth Online Archive, London School of Economics. Labels added for the purposes of this study.

The qualities of the immediate station area were also affected by the industrial activities to be found there. Around Paddington Basin, “a district of dust, dustmen and drink”, (Booth, 1902, B355 p. 197). Poverty and poor environment go hand-in-hand. In South Wharf Road, immediately east of the station, “Air in this road redolent of dust, dirty children eating dusty bread and butter, sore eyes…” (Booth, 1902, B355 p. 197). Paddington Basin was the off-loading point for refuse, which was stored in warehouses before being removed by barge. The street’s “doubtful reputation” is also described, with “Four known thieves living there and several third or fourth rate prostitutes who work Edgware Road and Praed Street” (Booth, 1902, B355 p. 215).

In Bayswater and Paddington Booth’s classifications darkened with proximity to the station frontage. Behind the station, north of the railway lines, this effect was much more widely spread and the areas of poverty noticeably more extensive. The Booth notebooks describe Westbourne Green as a “poor district south of Harrow Road… dustmen – cabmen – scavengers – vestry employees… fair earnings. good deal spent in drink” (Booth, 1902, B355 p. 213). Individual streets were identified as disreputable, including Delamere Crescent – “bad repute. Kept women and prostitutes” (Booth, 1902, B355 p. 203) – and Westbourne Park Crescent - “prostitutes but no brothels” (Booth, 1902, B355 p. 203). The neighbourhood, described as “between Paddington GWR and the canal”, received some of the most unequivocal condemnation to be found anywhere in the Booth Survey notebooks. This is surprising because, while the map shows poverty, it is by no means the poorest part of inner London. Instead, it was the depressing atmosphere of the area that struck Booth's researcher: “Everywhere a want of life and signs of decay. Houses built for a class which does not and perhaps never has lived in them” (Booth, 1902, B355 p. 233).

The character of the neighbourhood was described in terms of its spatial relationship to the railway. The closer the streets, the poorer they were, despite consisting of the same building stock: “In this district a house may get up and walk and find itself first yellow, then red, after that pink barred and pink until at last it is dark blue in Clarendon St. The building is the same; the inhabitants differ” (Booth, 1902, B355 p. 233). This entry referred to an area on both sides of railway lines, from Westbourne Grove south of the railway lines to the limits of Westbourne Green. Proximity to the railway lines was the common feature that binds these streets together on a shared trajectory. The notebooks conclude “The history of these streets is a history of decay. London has refused to go cheerfully out of town in this direction. A district of wastrel west enders as Hackney Wick is of wastrel east enders” (Booth, 1902, B355 p. 233). Hackney Wick, incidentally, was (and still is) an island of residential streets surrounded by railway infrastructure and industrial waterways, with spatial similarities to Westbourne Green. The Booth Survey's wholly negative views of an apparently respectable part of town are matched only in the Pimlico area (see Chapter Nine: Discussion and Conclusions), where another spatially isolated area behind a station was described as experiencing a similar decline.

Paddington Green, adjoining Westbourne Green to the east, had a similarly varied social profile – "typical mixed streets" (Booth, 1902, B355 p. 211). There was, however, a sense of decline here too with some streets becoming poorer between the two surveys (1889 and 1898). Booth's researcher was accompanied by a local policeman, who attempted to explain this: "Knight thinks that the 'red' people have either gone into the new flats in central London or moved to the country" (Booth, 1902, B355 p. 211).

The area around Lisson Grove was dominated by the clearances for the construction of Marylebone Station and the Great Central Railway, which were under way at the time of the 1898 Booth Survey. The notebooks made an explicit link between the demolitions and the falling fortunes of the area: "The changes in this district… are due to the accidental cause of the demolitions for the railway: there is no reason to suppose that these streets and Blandford Square would otherwise have fallen in the social scale" (Booth, 1902, B358 p. 251). Disruption was also noted from the workers for the large construction project, for example in Burne Street next to the demolitions "…largely used lately by navvies employed in making the Great Central Railway, a very rough lot who had led to many drunken rows…" (Booth, 1902, B358 p. 19).

The Lisson Grove neighbourhood, between Edgware Road and the Marylebone clearances, had the most concentrated of darker colours in the whole district, and was described in the notebooks as very poor, with "Signs of poverty… much more common than in other poor districts I have examined with equal care" (Booth, 1902, B358 p. 25). Although the notebooks reported that the streets were generally well-maintained, the poorest streets in the area were an exception. Many individual streets in this area were described as being in bad condition with residents who appeared poor: for example, Venables Street with "Filthy, squalid houses: fowls and garbage in the roadway: a good many draggled looking women at doors and windows" (Booth, 1902, B357 p. 235).

The area was compared with Notting Dale, just to the west of the map in Figure 6.16, notorious for its poverty. Booth's researchers made a direct link between the decline of Notting Dale and the railway construction in Lisson Grove: "When the clearances were made in Lisson Grove for the Great Central Railway, those who knew the people came here and hired all the houses they could. They knew that the natural drift of such a class was to Notting Dale. It was the only district with a similar class that had room for more… The number of bad streets has increased until there is no such extensive criminal quarter in any part of London" (Booth, 1902, B359 p. 157).

The data in Table 6.7 showed that Paddington and Marylebone were divided in terms of wealth. A much higher proportion of Yellow and Red streets was found in front of the stations, and a higher proportion of the poorer four categories were found behind. There were no Black street segments at all in Bayswater, Paddington or Marylebone.

Booth Survey category		Count	Segment Length	Choice 3000m	Integration 800m
Yellow: wealthy	Front	460	70	724138549	7866
	Back	84	57	457598719	6091
Red: well-to-do	Front	445	60	611420836	8922
	Back	283	56	361162398	6459
Pink: fairly comfortable	Front	196	49	442869230	8619
	Back	128	54	260022832	6152
Purple: mixed	Front	69	57	376242306	7721
	Back	129	58	302377937	6976
Light Blue: poor	Front	12	48	173245445	6409
	Back	115	61	325698140	6481
Dark Blue: very poor	Front	5	26	45630257	6042
	Back	23	76	648903106	7597
Black: lowest class	Front	0	0	0	0
	Back	5	71	25681359	5702

Table 6.7: Mean spatial data and Booth, Paddington and Marylebone 1898.[54]

[54] Lower value of the two time periods shown in red, for ease of comparison.

Values for Choice at 3000m and for Integration at 800m match social category, with higher values for wealthier streets. However, there is an exception to this, with Yellow streets less integrated than Red – a pattern matching that discussed in Chapter Five – Euston, King's Cross and St. Pancras Stations, where Integration values in East London increased with wealth, except for the Red category, which was better integrated than the Yellow (Vaughan and Geddes, 2009).

The least integrated streets are those with Black (Lowest) and Dark Blue (Very Poor) categories, although there are many fewer in these categories than in the wealthier ones. Nevertheless, the figures confirm that areas of poverty are relatively much more segregated, which is clear from Figure 6.20.

Figure 6.21 shows the GLA Household Income Estimates mapped for Lower Super Output Areas (LSOAs) in Paddington and Marylebone. It shows that the areas in front of either station fall entirely into the top four income brackets. This includes sections of the street grid east of Marylebone Station and in Paddington/Tyburnia and Bayswater. Paddington/Tyburnia remains a neighbourhood of choice for the wealthy with, for example, former Prime Minister Tony Blair setting up home in Connaught Square after leaving office in 2007.

Behind both stations the picture is entirely different. The neighbourhoods north of the railway and the Westway and behind Marylebone fall entirely into the bottom four income categories. Westbourne Green, Paddington Green and Lisson Grove are defined not just by the separation created by rail, roads and canals but also by their relative poverty when compared to places that are next door, yet socially very distinct. The choice of sites behind the stations for building social housing may have fixed their long-term status as low income neighbourhoods, but was itself directed by the already established poverty of those areas, and by the availability of land adjacent to active, busy rail corridors for which demand was limited.

The pattern of Choice and Integration values is to some extent comparable with those for the Booth poverty survey (Table 6.5). Segments falling within the highest income band LSOAs have slightly lower Choice and Integration values than the next wealthiest band, but otherwise mean values fall along with income. This suggests an element of continuity across a long period of time in the relative balance of wealth and poverty in the whole area, and in its spatial distribution in front of and behind stations.

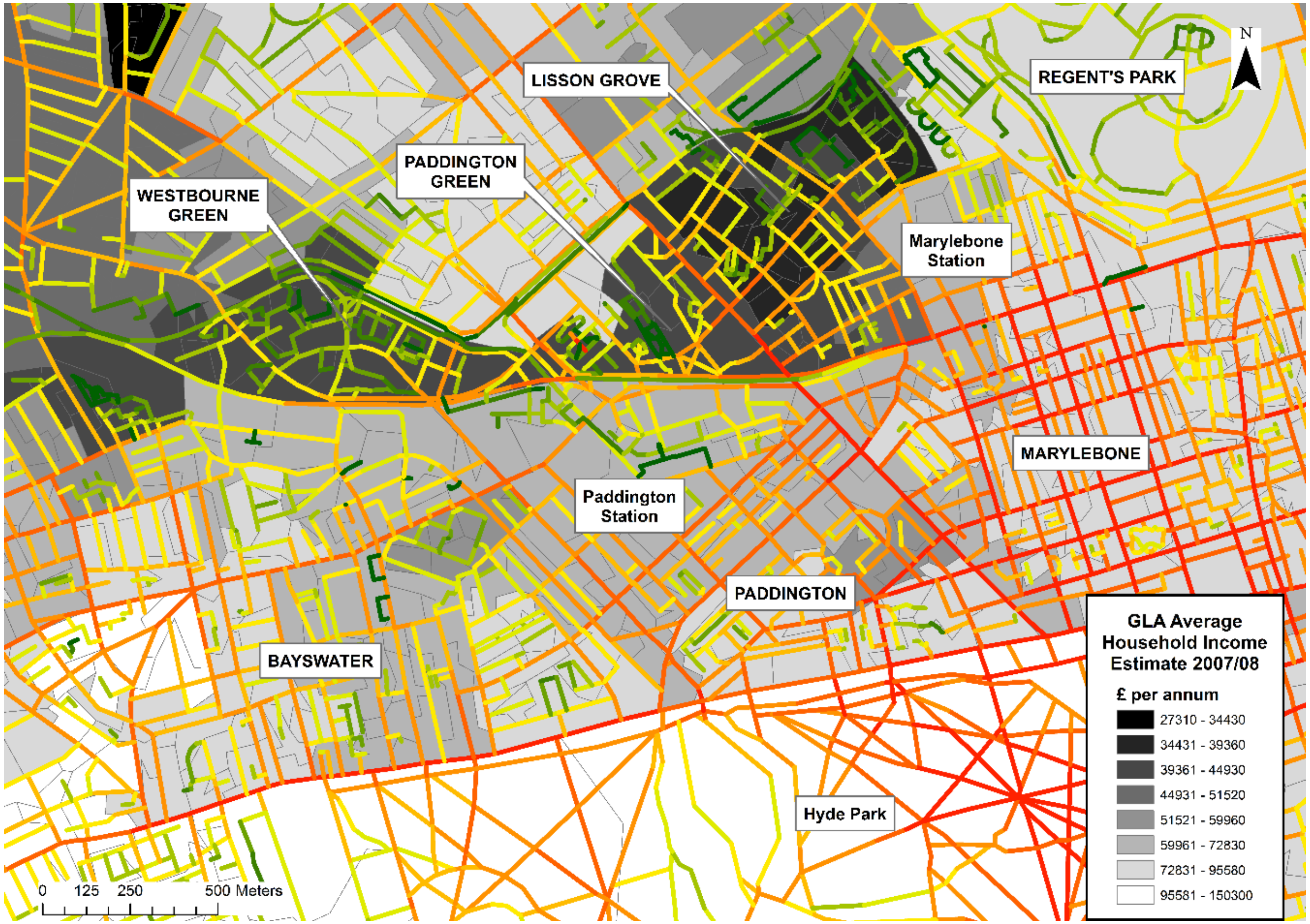

Figure 6.21: Paddington and Marylebone, GLA Household Income 2007/08, Integration 800m.

However, wealth and poverty have polarised since the late nineteenth century. The streets behind the stations include no households in the top two income bands, while the streets in front contain none within the bottom two bands. In the 1880s the poorest households were also absent from Bayswater, Paddington and Marylebone. However, a full range of income levels was found in Westbourne Green, Paddington Green and Lisson Grove. This is no longer the case, and these neighbourhoods are now poorer and more homogenous in terms of relative wealth.

Compared with the 1880s Integration values have risen for most of bands in front of the stations, but have fallen for the lower income bands found behind the stations. Mean segment length now drops with income band, which was not the case in the 1880s when the lowest income levels were found on longer segments than those above them. This supports the conclusion that "In the contemporary city a greater polarisation of wealth has developed" (Vaughan and Geddes, 2009, p. 23), with both the poorest and the richest living in more segregated parts of the spatial network. Dorling *et al.* also compare the Booth Survey with contemporary income data, concluded that Booth "describes "area type" rather than the aggregate characteristics of the resident population" (Dorling, Mitchell, Smith, Orford and Davey Smith, 2000, p. 1550). The power of Booth's data to predict mortality rates in the 1990s is linked to the spatial characteristics of the area, and to disruption of spatial networks.

Mean household income estimate	Neighbourhood	Count	Mean Segment Length	Mean Choice 3000m	Mean Integration 800m
£96,131-£139,510	Front	15	112	286754250	8141
	Back	0	0	0	0
£83,291-£96,130	Front	264	65	512998095	8639
	Back	0	0	0	0
£75,061-£83,290	Front	560	70	316095099	8320
	Back	287	72	403457134	6136
£66,181-£75,060	Front	768	71	307563218	6119
	Back	208	70	271437826	5934
£51,311-£66,180	Front	422	65	279943235	6604
	Back	217	72	423153839	4963
£45,851-£38,360	Front	0	0	0	0
	Back	105	53	471018012	5336
£38,670-£45,850	Front	0	0	0	0
	Back	675	51	191766992	3701

Table 6.8: Paddington and Marylebone, GLA Household Income 2007/08 with spatial data.[55]

[55] Lower value of the two time periods shown in red, for ease of comparison.

Discussion and conclusions

Paddington and Marylebone Stations came into existence 60 years apart, at either end of the nineteenth century railway boom. The rail transport system on which London has relied ever since was created during these decades, and the fortunes of the neighbourhoods surrounding both stations provide insights into the impact of a terminus in contrasting circumstances. While the streets behind Paddington grew with the station, those behind Marylebone had a station thrust upon them.

By the time Paddington Station was constructed, inner London was fully built up to the Edgware Road. The Portland Estate development of Marylebone provided the basic grid structure of the West End; the neighbourhood of Tyburnia extended the grid west of Edgware Road at the same time that the station was built. When the Great Western Railway arrived, Paddington Green was already a nascent transport hub for journeys into London; the addition of the station to the existing a canal junction and basin cemented the area’s role as a combined industrial hub and passenger terminus, serving the West End.

Spatial analysis reveals the structure of the main roads that encloses inner London, including the Marylebone Road. The positioning of Paddington next to main north-south and east-west through routes created clear neighbourhood boundaries that were reinforced by subsequent development. The neighbourhoods behind Paddington were always socially less desirable than those facing the station, less impressively conceived and designed, and more isolated, being defined from early stages by transport barriers. Local Integration, with neighbourhood high streets at the core of Westbourne Green and Paddington Green, has been eroded by regular reinforcement of the Paddington railway cutting as a separating structure, compounded by the Westway and the canals. Even the main feature of Westbourne Green, the open space after which it is named, has a council information board tracing its history back to its use as a works site for the Westway, but no further. The area is surrounded and dominated by outsized transport structures.

The construction of Marylebone Station, despite its site being outside the 1846 railway exclusion zone, required the demolition of many streets and the displacement of a large number of people. It is notable how, despite the established network of streets behind the station, the spatial effects seen behind the new station are very similar to those found behind Paddington. The grid facing the station maintains its range of land uses, and has remained a consistently wealthy and desirable location. Behind the station, the barriers introduced by the railway lines have led to separation, a sharp contrast in social, economic and spatial fortunes, and a history of major reconstruction and rebuilding.

The route of the railway approaches to Paddington and to Marylebone can be easily identified simply through current land use or estimated income maps: the contrast in land use density and in relative poverty between areas on either side of the tracks is unmissable. The disadvantages of being located behind either of these stations can be traced back to the late nineteenth century. Patterns of poverty behind Paddington appeared only after the station was built, but were already established in Lisson Grove when Marylebone arrived. The railway may have fixed these patterns in place, by ensuring that these areas would be less desirable than contrasting areas that are physically very close but spatially poorly linked.

Later development of estates on former railway sites next to the tracks has further cemented patterns of relative poverty in locations behind the stations. However, as seen in other London station areas, the streets behind stations, despite showing evidence of blight, are not completely lacking in activity. The long-established market location of Church Street contains a greater concentration of independent businesses in small footprint buildings than anywhere else in the study neighbourhoods. The balance between separation from adjacent neighbourhoods and local connection to streets with the neighbourhood seems to provide sympathetic conditions for this form of economic life. Residents and shoppers in Church Street Market may not consider Marylebone or Paddington as being particularly relevant or close to their street. But the self-contained Lisson Grove is a neighbourhood defined spatially by the station and by wider transport infrastructure. Jones (2016) suggests that London's street markets flourished during the second half of the nineteenth century in "extramural" conditions, operating on the "frontiers of modernity" both socially and spatially. In practice, this meant that long-established markets occupied marginal spaces, at the expanding edges of London. Church Street fits these criteria very well, maintaining a presence although surrounded by expansion and change.

The characteristics of Church Street are those of a local centre, with a different composition to the West End streets on the other side of Marylebone Road, but just as distinctive and particular to its surroundings. While Paddington Green and Westbourne Green have lost their high streets, Lisson Grove has retained Church Street and with it an identity that, unlike its neighbourhoods, goes beyond the most recent phase of estate reconstruction.

The next chapter analyses the surroundings of Waterloo Station, also a product of the 1840s railway boom.

Chapter Seven: Waterloo Station

Introduction

Waterloo Station is located on the south bank of the River Thames, 500m from the river and 1km from both the Cities of London and Westminster, as shown in Figure 7.1.

The station sits inside a ninety degree bend in the River Thames, and therefore has water both to the west and the north. Although it is part of a network of viaducts crossing the Thames and the South Bank, there are no through rail routes from Waterloo, and all trains terminate there. It is adjacent to lines that cross the river to Charing Cross, Blackfriars and Cannon Street Stations but has no direct rail connection to any of these. Instead, a pedestrian bridge links to the separate Waterloo East through station, for Charing Cross and London Bridge.

Waterloo is the terminus for services to the south west of London, combining commuter trains to South West London with services beyond the capital to Berkshire, Surrey, Hampshire, Wiltshire, Dorset and Devon. It is the busiest station in Britain, in terms of entries, exits and interchanges. All the main London terminals feature in the top ten busiest stations in the country but Waterloo, with more platforms than any station in Britain, heads the list (Office of Rail and Road, 2015).

History

The first station on the current Waterloo site opened in 1848, built by the London and South Western Railway Company (L&SWR). It replaced the original Nine Elms terminus (built by the London and Southampton Railway, the L&SWR's predecessor), 3.5km further south in Battersea on a site now occupied by New Covent Garden Market. Figure 7.2 shows the site of the station shortly before construction began.

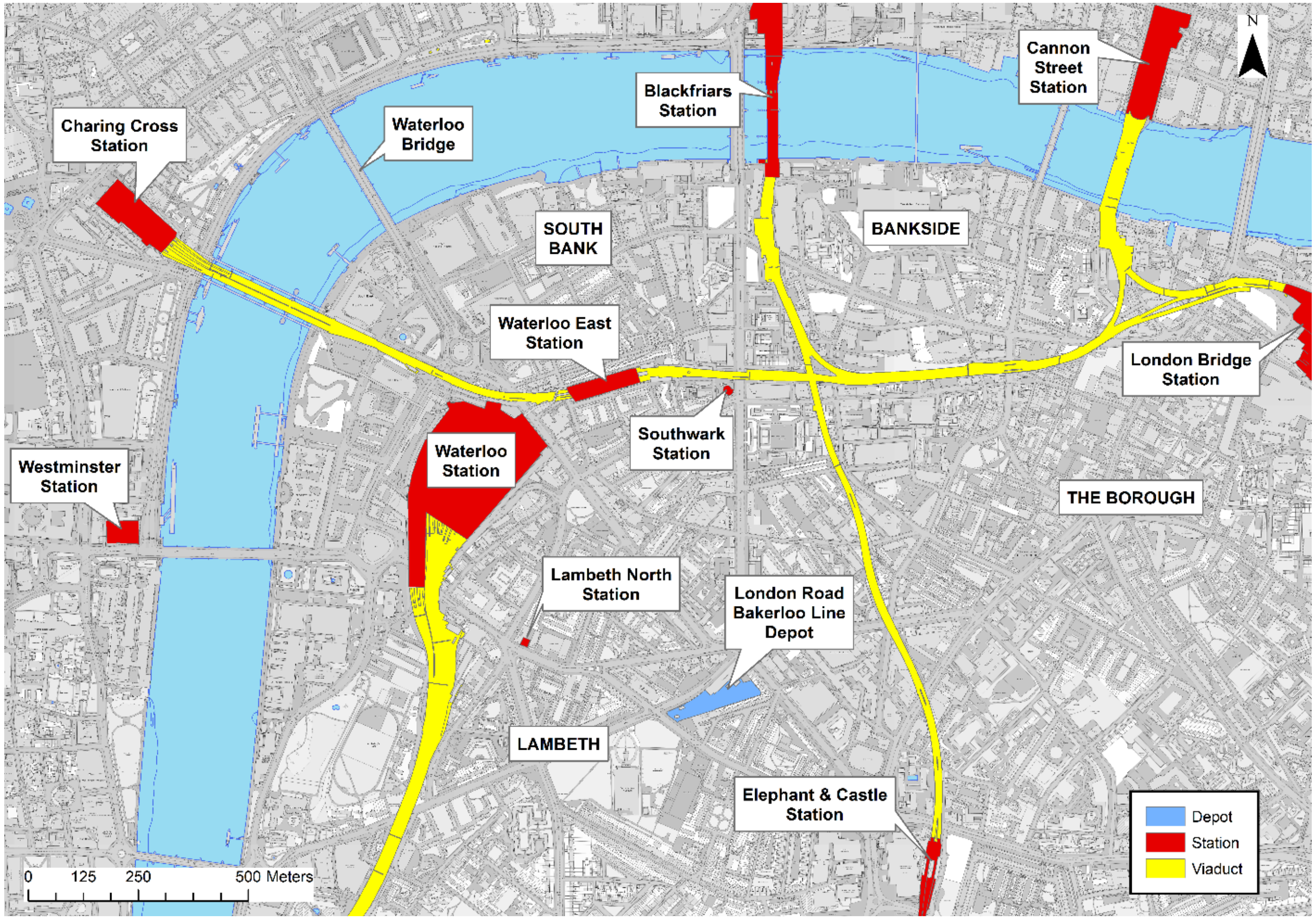

Figure 7.1: Waterloo Station and infrastructure.

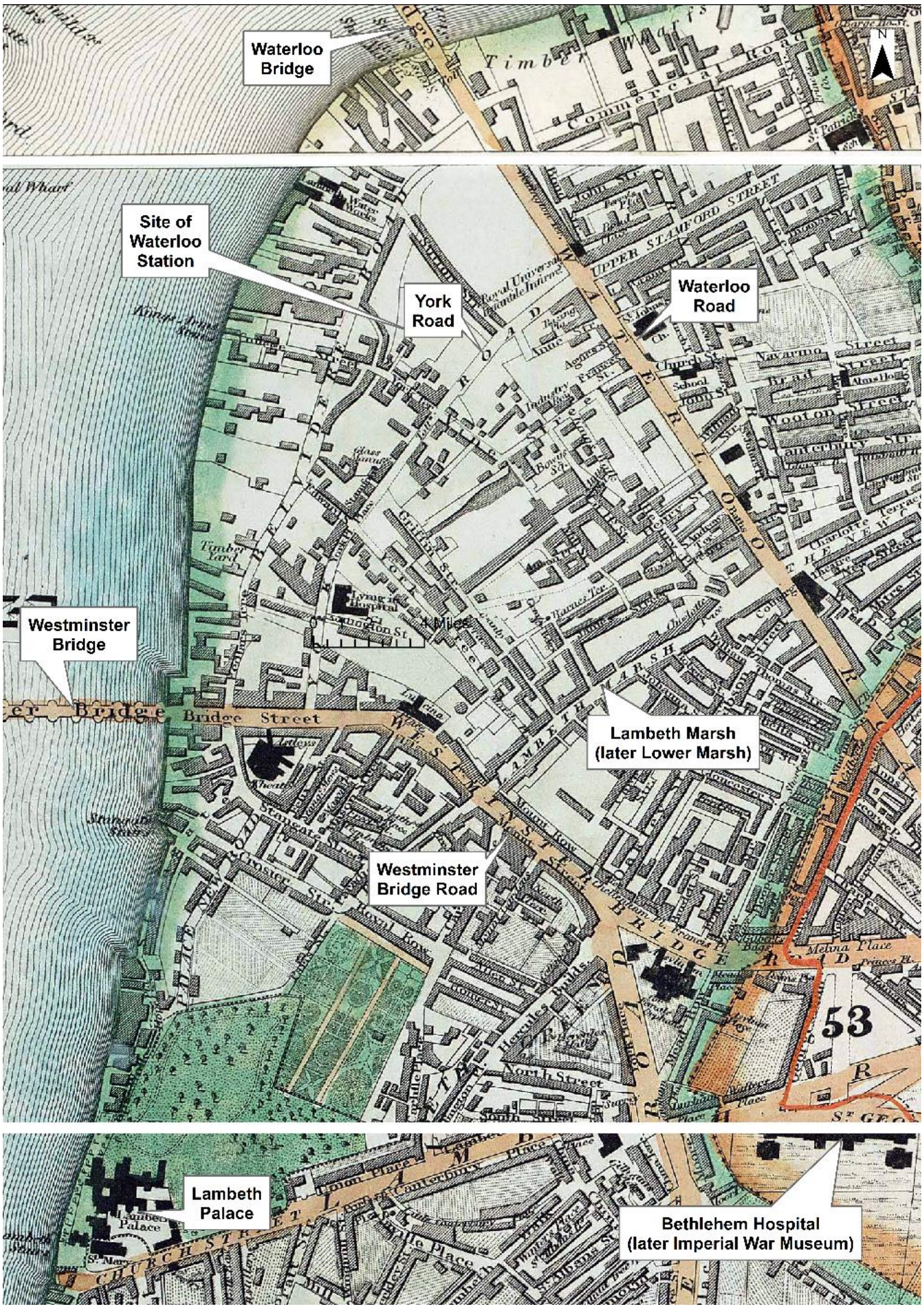

Figure 7.2: Waterloo area, Greenwood Map 1827.[56]

[56] White lines across the map indicate missing information at the edges of adjoining sheets.

Nine Elms Station opened in 1838, but proved too far from central London to be convenient for passengers, who were obliged to continue their journeys by river or road. To extend the line to within reach of Westminster and the City, the L&SWR bought a disused pleasure garden off York Road, located between Westminster and Waterloo Bridges. The extension of the line from Nine Elms to the new terminus site was a disruptive project. The construction of a viaduct through a built-up area required the demolition of 700 houses (Jackson, 1985). The lines passed through 1,600 properties, a combination of "cottages, parcels of land, hop warehouse, coach sheds and yards" (Kellett (1969, p. 255). All the land along the 3.5km route belonged to a single landlord, the Church of England (in the form of the Archbishop of Canterbury), which made no opposition to the proposal. Kellett suggests that the Church, which owned contiguous estates stretching from Lambeth Palace to London Bridge, "viewed some of the property it owned with very mixed feelings" (Kellett (1969, p. 258). Despite the extent of its landholdings south of the river, the Church had no strategy as a landlord to manage development, either architecturally or socially, nor did it make any attempt to mitigate the effect on its property of the multiple railway projects constructed during the middle decades of the nineteenth century.

However, the design of the Waterloo extension was intended to reduce disruption and the associated costs for the L&SWR. The new line was carried on a brick viaduct with 200 arches, allowing it to cross 21 roads along its route none of which needed to be permanently closed. The route also made three sharp curves to avoid Vauxhall Pleasure Gardens, Vauxhall Gas Works and Lambeth Palace. Nevertheless, viaducts were controversial structures. The Metropolitan Commissioners, tasked in 1846 with recommending a strategy for locating terminals in London, took evidence from many witnesses and petitioners. These included representations against the L&SWR's proposed line from Waterloo to Bankside, an additional route that was never built. One complainant suggested that a viaduct on this route would "have the effect of "enclosing, as it were the southern part of the metropolis with a brick wall and preventing all future improvements" (Metropolitan Commissioners, 1846, Ap. 1, p. 249). Viaducts, it was suggested, would "render the intercourse between inhabitants on each side of the railway difficult", and were "contrary to the feeling that has abolished city walls and gates as obstructions to business and recreation, and has substituted parks and open spaces" (Metropolitan Commissioners, 1846, Ap. 1, p. 256). Viaducts were contrasted with the approaches to Euston and Paddington "which are in cuttings, and therefore not injurious or very obnoxious" (Metropolitan Commissioners, 1846, Ap. 1, p. 256).

Viaducts were seen as barriers, but complaints also associated them with a variety of negative impacts on the prospects of the area. As well as destroying houses they would, it was suggested, render “all properties contiguous to, but not required by, the line [of the viaduct] of little or no value” (Metropolitan Commissioners, 1846, Ap. 1, p. 249). Another petitioner, referring to an East London proposal, told the Commissioners that “…of all modes of extending the railways into London, a viaduct is the most objectionable: it would not be tolerated in a respectable neighbourhood, and undoubtedly renders a bad one worse” (Metropolitan Commissioners, 1846, Ap. 16, pp. 273-74). A consensus about the detrimental effects of viaducts emerged during the nineteenth century as railway arches became a common sight across the country. Evidence to the Commission stated that the London and Greenwich Railway (L&GR) had anticipated revenues from letting out arches between London Bridge and Greenwich, but that they “remain nearly wholly useless or unlet” (Metropolitan Commissioners, 1846, Ap. 1, p. 249). They were apparently used by people with nowhere else to sleep and, as a result, became symbol of urban dereliction. Augustus Egg’s ‘Past and Present’ triptych, painted in 1858, depicts the fate of an unfaithful wife who, in the final picture, is reduced to sleeping rough under an arch. The nature of the neighbourhoods associated with railway viaducts is illustrated by Gustav Doré, twin railway bridges crossing Battersea on high arches above the squalor of the crowded terraces.

The Waterloo extension was approved shortly after the Metropolitan Railway Commissioners concluded that future terminals should be excluded from central London. Waterloo Station was therefore built close to the Thames, which formed the southern boundary of this exclusion zone. However, although the site was an improvement on Nine Elms, the L&SWR saw Waterloo as too far from commuting destinations in and around the City, and not quite close enough to the Thames to handle goods direct from the wharves, so continued to pursue a north bank station. Abortive attempts to finance an onward link led to uncertainty, and caused Waterloo to be developed piecemeal.

New platforms and station extensions were added in 1860, 1869, 1878 and 1885. The two latter additions were known, topically when built but bafflingly thereafter, as ‘Cyprus’ and ‘Khartoum’, and operated independently both from the rest of the station and from each other. A separate Necropolis station opened in 1854, a private enterprise transporting coffins and their occupants to the London Necropolis cemetery at Brookwood, Surrey. It later moved to a new site on Westminster Bridge Road, for which parts of several streets were demolished.

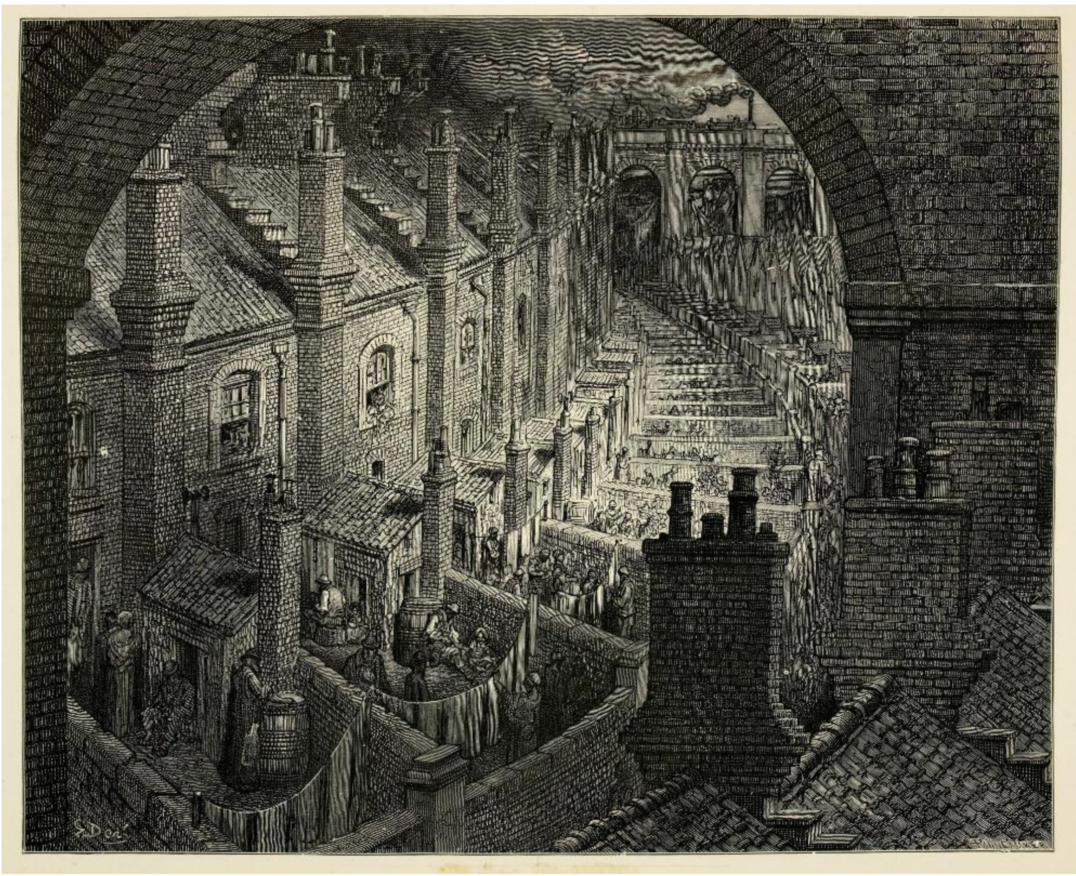

Image 7.1: ‘Over London-by Rail’, Gustav Doré, 1872.[57]

By the end of the century Waterloo had 16 platforms but only ten platform numbers, several of which were duplicated. Haphazard organisation gained the station a reputation for being impossible to navigate, as represented by Jerome K. Jerome in his comic novel ‘Three Men in a Boat’ (1889), in which the confused protagonists eventually abandon their search for the Kingston train, and resort to bribing an engine driver.

Figure 7.3 shows the growth of the station and its associated structures. The North Lambeth area, occupied by Waterloo Station was seen during the nineteenth century as “a classic example of the process of railway blight” (Binford, 1974, p. 134), having made the transition over the course of 50 years from a middle class and skilled working class area within easy reach of Waterloo Bridge, to “a dirty and degraded backwater” (Binford, 1974, p. 135). The construction and expansion of the station caused regular disruption. When first built Waterloo Station occupied a ten acre site, for which parts of eight surrounding streets were required as well as the derelict land purchased by the L&SWR. The station was entirely rebuilt between 1904 and 1922, resolving its notorious complexity and requiring the clearance of additional streets between Waterloo Road and York Road. The station approaches had

[57] © The British Library Board, Wf1/1856

already been expanded in 1890, with new tenements built to rehouse 1,041 of the people displaced in Vauxhall as a result (Jackson, 1985). The Charing Cross viaduct in front of the station was also widened in the 1890s, requiring the demolition of the remaining streets between the station façade and the viaduct.

Another attempt to provide a link to the City, the uniquely short, two-stop Waterloo and City Underground line, opened in 1898 after the demolition of houses on the south-east side of the station to make space for its sidings. Between 1890 and 1910 the principal roads on this side of the station, Aubin and Lancelot Streets, were both lost to station expansion along with several smaller connecting streets.

The Metropolitan Commission's exclusion of new terminals from central London was relaxed in the 1860s to allow both Cannon Street and Charing Cross Stations to be built on the north bank of the Thames, connected by a viaduct passing the front of Waterloo Station. However, the L&SWR never achieved its ambition of a City terminus. A new station, Waterloo Junction (now Waterloo East), opened in 1869 on the Charing Cross viaduct, but was owned and ticketed by a separate company. A rail link between Waterloo and Waterloo Junction was built at the same time, but it only allowed trains to run east to London Bridge and not west to Charing Cross, so was very little used. The bridge remains but services were discontinued and the track was taken up in 1925.

Since its 1922 reopening, the size and configuration of Waterloo has remained relatively stable. The remaining streets north of the station, between York Road and Waterloo Road, were demolished to create parking space for the 1951 Festival of Britain, space that was subsequently claimed for the Waterloo Roundabout. Then in 1989 work began to extend the station and widen the viaduct for the Channel Tunnel Rail Link, which terminated at Waterloo from 1994 until 2007. Construction involved the demolition of railway arches along the western side of the approach viaduct, which were let to businesses, and a small number of houses adjoining the viaduct. As shown in Figure 7.8, cumulative changes to the station and its viaduct increased its total area by 160 per cent by the 2010s.

Figure 7.5 shows the immediate surroundings of the station in 2014. Entrances and exits to and from Waterloo are located at the front of the station, on three levels. The platform and concourse level at Waterloo is elevated over a vaulted ground floor. Much of this is inaccessible to the public, but tunnels pass under the main concourse, giving access to Underground lines.

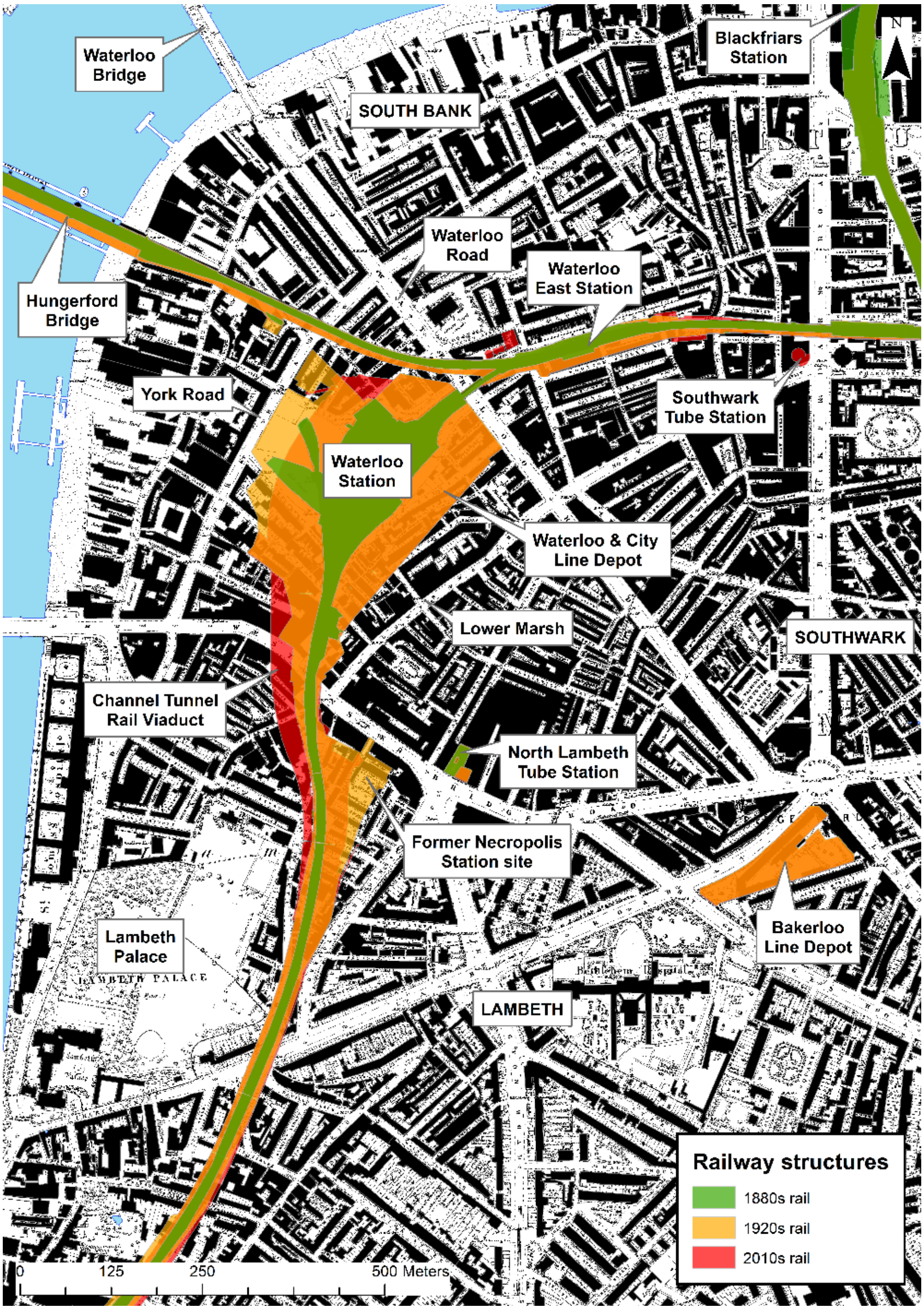

Figure 7.3: Waterloo Station expansion 1880s-2010s.

Two exits emerge at either end of this tunnel system at street level, on Waterloo Road and on the west side of York Road. A third exit tunnel passes from concourse level down beneath the viaduct in front of the station, emerging on its north side. A system of underpasses surrounds the IMAX (Waterloo) Roundabout but is not directly connected to Waterloo, surfacing a few yards outside the main station entrance.

Image 7.2: Station Approach Road, east side of station.

The main concourse-level exit is on the north station façade, emerging on to an elevated access ramp. The two exits at the north-west corner of the station also lead on to the ramped street (Station Approach Road, Figure 7.2) which runs around the north and the east sides of the station. Station Approach Road is connected to Lower Marsh via steps and a ramp, although the two streets are almost entirely concealed from each other. Another exit, at the north-east corner of Waterloo, emerges at first floor level on York Road, with steps down to the street. This is the remains of an elevated walkway that once passed through the Shell Centre to the Royal Festival Hall. Finally, there is an exit from the second-floor station balcony which leads only to Waterloo East Station, via a footbridge over Waterloo Road.

These multiple-level exits, several of which are not immediately apparent to the newly arrived traveller, echo the infamous complexity of pre-First World War Waterloo. Moreover, on leaving the station any view of potential destinations from the main front station entrance is cut off by the Charing Cross viaduct. Despite the number of exits all of them are orientated towards areas in front of the station, between Waterloo and the South Bank. No exits lead directly behind the station, and only the north-west corner exit provides indirect access to areas south of Waterloo Road.

Image 7.3: Entrance to Leake Street tunnel from Lower Marsh.

Meanwhile, the station approach viaduct crosses seven streets within 250 metres, creating a network of dark tunnels. Several of these streets are mainly used by buses and cabs, with their pedestrian status unclear. Figure 7.3 shows the south entrance to Leake Street, the longest and darkest of the tunnels, which is so forbidding that it became an approved graffiti site in the 2000s, taking advantage of its urban dereliction. It is, in fact, also the main access route between York Road and Lower Marsh, the main local shopping street, but few would realise this.

Waterloo neighbourhoods

Waterloo Station has several exits, arranged across the front of the main station building, and to the sides close to the frontage, shown in Figure 7.4. The viaduct passing across the station frontage obscures the main entrance, and both tunnels and walkways have been introduced to carry passengers over and beneath surrounding roads. While the formal arched entrance is the main frontage for the station at platform level, it also has a secondary ground-level frontage to the east on Waterloo Road. Further exits lead across York Road on a footbridge, below ground level in front of the station, on a bridge across Waterloo Road to Waterloo East Station, and two further routes to the taxi road in front of the station, and to Station Approach Road on its east side. Despite, these multiple options, there is no direct route leading in or out at the back of the station.

Defining distinct neighbourhoods with clear boundaries is straightforward at Waterloo, as shown in Figure 7.5, because the station sits between main roads that radiate, like the spokes of a wheel, from St. George's Circus to the Thames bridges. These divide the surrounding areas into wedge-shaped sections. Waterloo sits at the centre of the Bishop's local electoral ward, which covers almost the full analysis area shown in Figure 7.5. The viaducts crossing in front of the station create a separation between front and back areas, along with Waterloo Road which continues the line of the station frontage.

The area in front of the station is bounded by the river to the north and Blackfriars Road to the east. The area behind the station is bounded by the river to the west and Lambeth Road to the south. It is notable that while the area in front of the station is universally known as the South Bank, the area behind the station has a less clearly defined identity. The local ward name, Bishop's, has no wider currency and the name North Lambeth seems to be used only for the Bakerloo Line Underground station on Westminster Bridge Road. Streets immediately adjacent to the station are described as being located in Waterloo, but this name does not extend as far behind the station as the area shown above. Much of the area has historically been known as Lambeth, although its centre was later located a little further south (the London Borough of Lambeth extends to a much larger area, a product of the 1965 reorganisation of London government which has confused perceptions of local geography still further). For the purposes of this analysis the area behind Waterloo is described as Lambeth. However, the fluid identity of such as long-established, central district area is a surprising phenomenon perhaps reflecting, as discussed below, the extent of the change it experienced during the twentieth century.

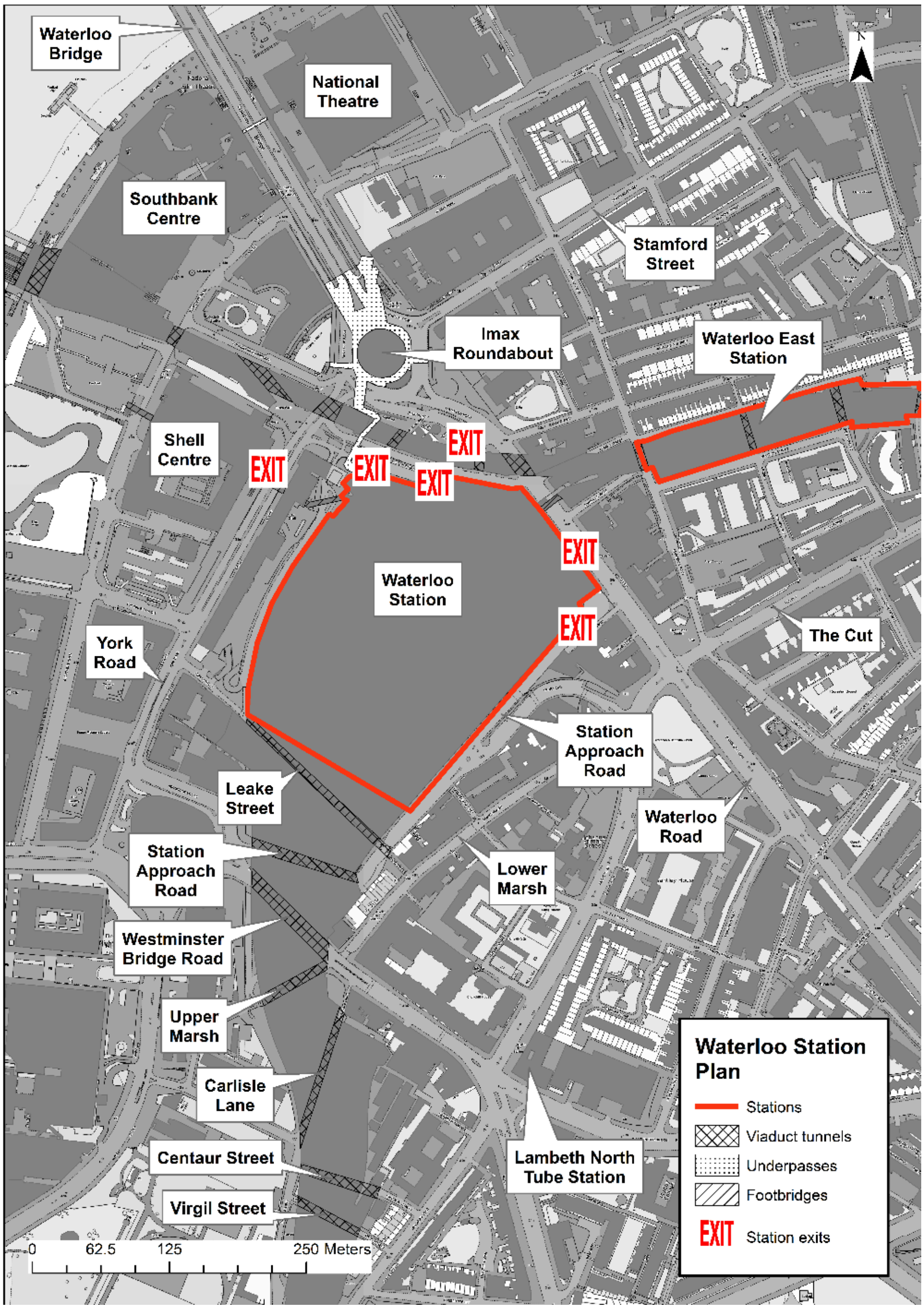

Figure 7.4: Waterloo Station plan 2014.

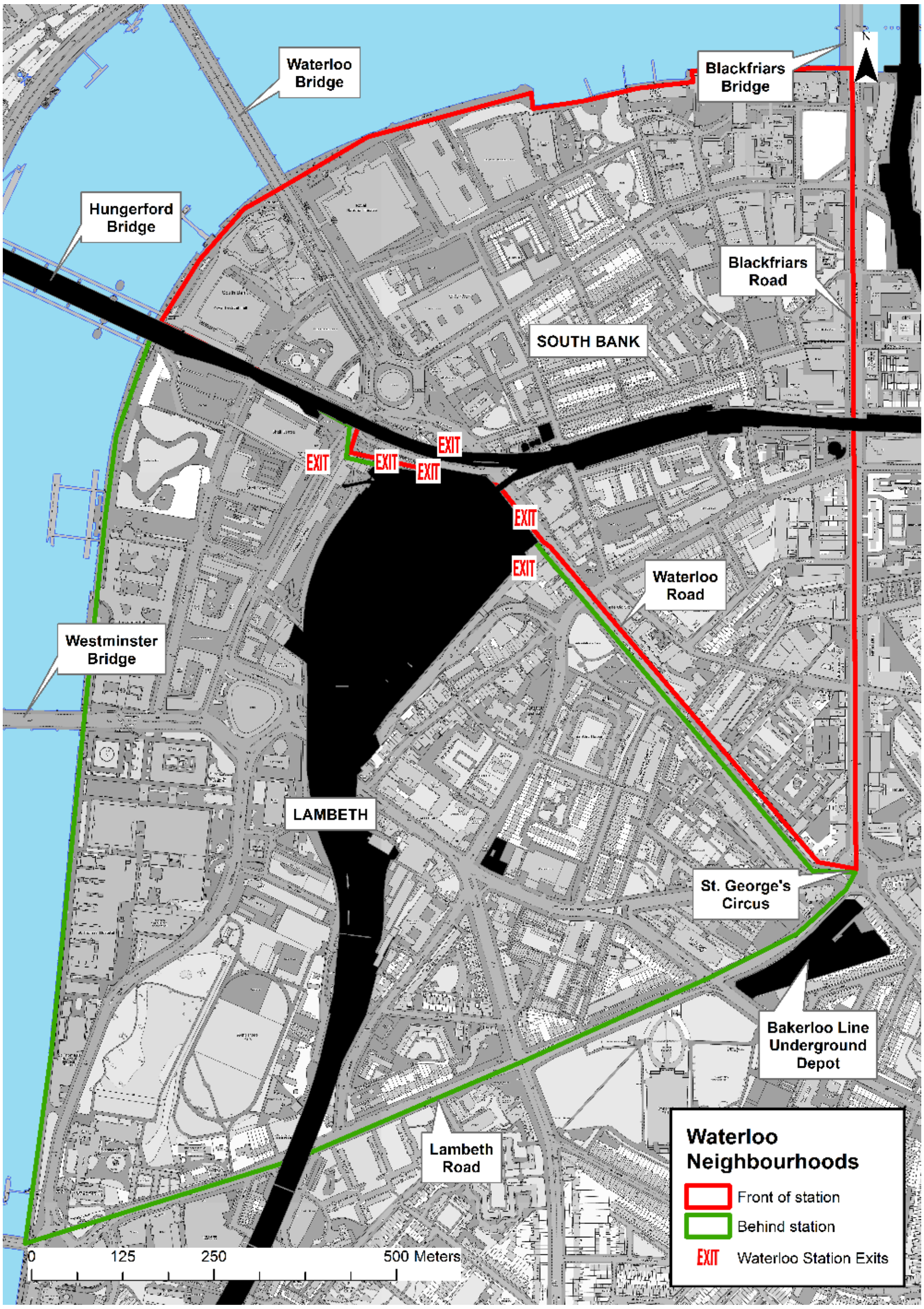

Figure 7.5: Waterloo neighbourhood boundaries.

Figures 7.6 and 7.7 (below map block sizes in Waterloo area in the 1880s and the 2010s. Station buildings and railway lines are shown divided into separate blocks where a road passes above or below them, to illustrate the extent to which they form physical barriers to movement. Waterloo Station was the largest block in the area in the 1880s – 23,742m^2 – and it remains the largest in the 2010s, having grown to 65,121m^2. The largest railway blocks after the station itself are the Waterloo approaches. However, while these blocks are substantial (the section between Leake Street and Station Approach Road alone is 9,053m^2) they are not the largest structures in the area. Measured to Westminster Bridge Road, the total area covered by station and viaduct increased from 51,333m^2 in the 1880s to 133,533m^2.

Since the 1880s the riverfront has changed almost entirely, and the wharves then located between Lambeth Bridge and Blackfriars Bridge have been comprehensively demolished. In their place are a series of cultural, governmental and health institutions which occupy blocks larger than anything other than Waterloo Station. County Hall measures 15,947m^2; the National Theatre 13,262m^2; St. Thomas's Hospital includes blocks that measure 11,112m^2 and 10,514m^2; the Shell Centre is 9,216m^2. The riverfront east of Waterloo Bridge is also lined with large blocks, all 7,000m^2 or more.

This represents a sharp contrast with the 1880s, when the only riverfront blocks of comparable size were the original St. Thomas's Hospital buildings. The Waterloo area was mostly occupied by housing and industry in close proximity, a similar urban fabric to that found to the east in Bermondsey. The Waterloo area hosted numerous industries, including distilleries, saw mills, japan works, and soap, candle, jam and pickle factories. The riverfront itself was occupied by a combination of wharves, large depots and factories, including the Government's India Store Depot and the landmark Lion Brewery at Waterloo Bridge.

The largest blocks beyond the station and the hospital were found behind Waterloo Station on Westminster Bridge Road, which was the area's high street. It hosted a combination of community, retail and manufacturing functions and the street contained a series of town centre-style buildings, including swimming baths, a theatre, two cinemas and three churches. Here, the Maudslay Engineering Works formed the largest single building (16,429m^2), the factory at the centre of the block surrounded on all sides by terraced housing. Vestiges remain, but Westminster Bridge Road is now dominated by the widened Waterloo viaduct, the expansion of which lead the demolition of significant buildings on the west side including Lambeth Baths, which had been the largest swimming pool in the country when it opened in 1853.

Figure 7.6: Waterloo block sizes, 1880s.

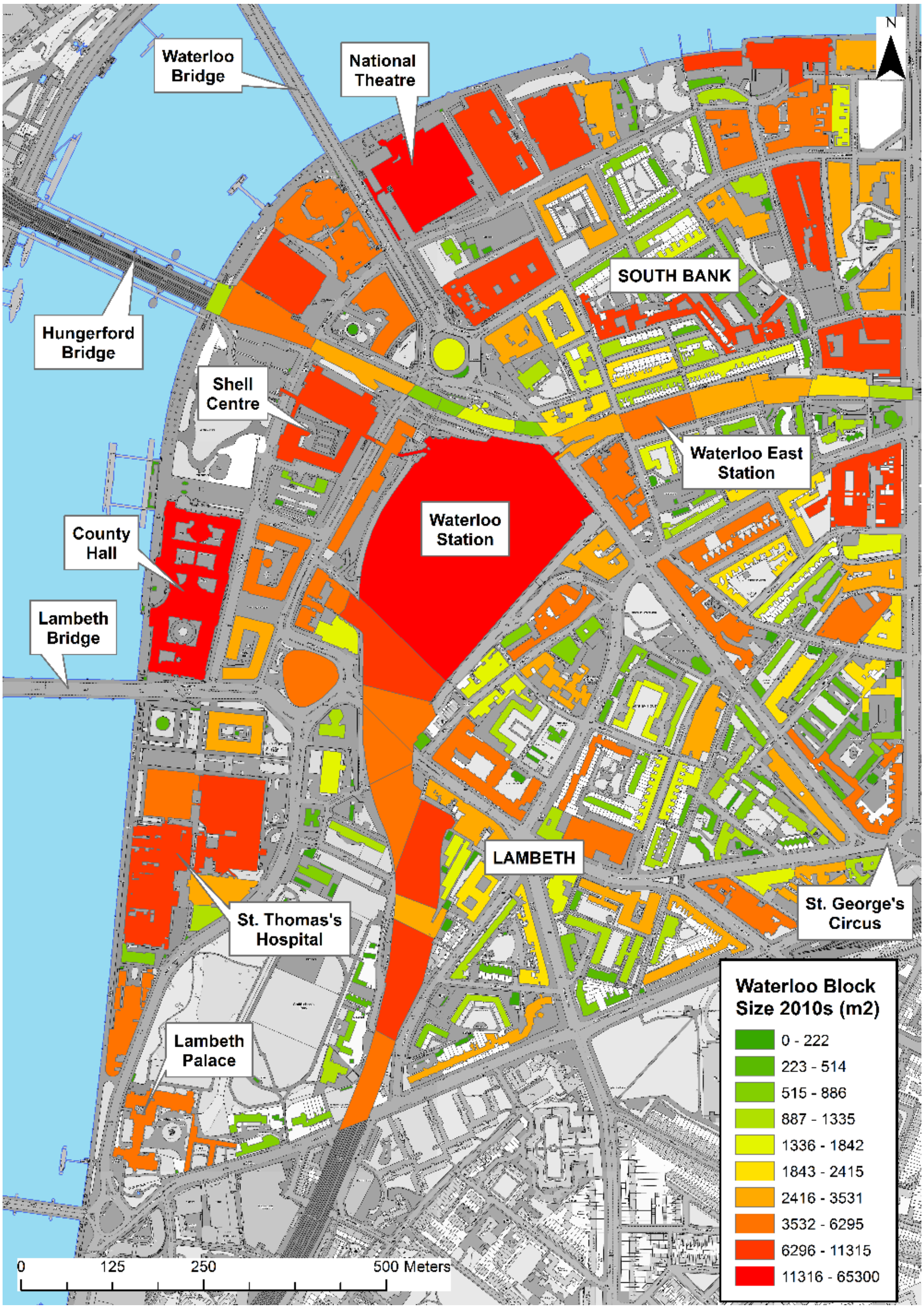

Figure 7.7: Waterloo block sizes, 2014.

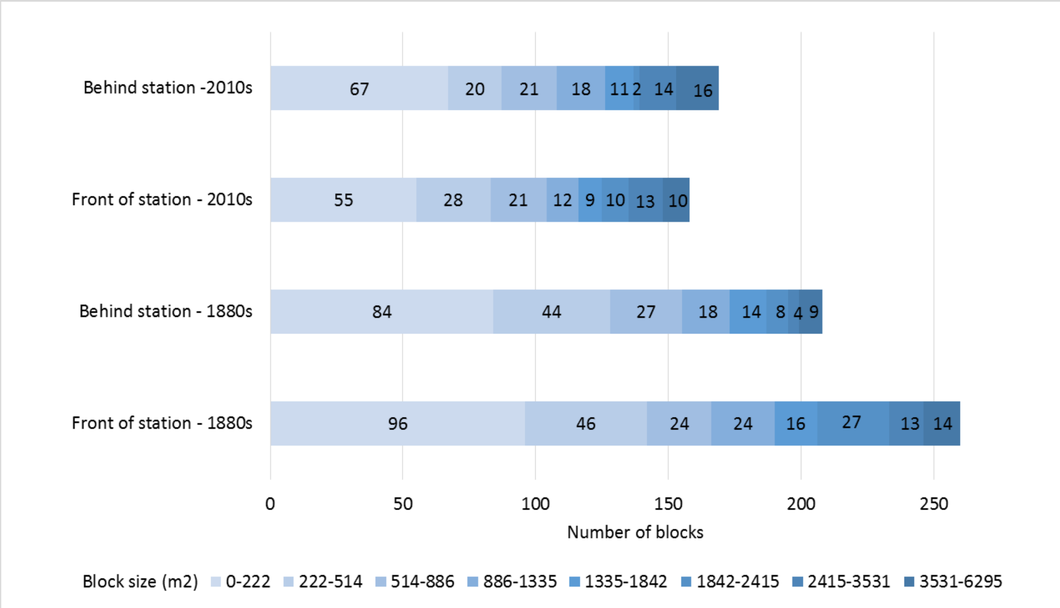

Figure 7.8: Frequency distribution of blocks by size, Waterloo, 1880s and 2010s.

Figure 7.8 shows that the aggregate number of blocks in both areas has fallen since the 1880s, but by a greater proportion in front of the station. The total number of blocks in front fell from 166 to 104 (37 per cent fewer) between the two periods, and behind the stations from 155 to 108 (30 per cent fewer). These changes reflect the reconstruction of the riverfront, with smaller, wharf blocks replaced by larger institutions.

The distribution analysis reveals different size profiles either side of the station, a difference that has persisted despite other changes. Blocks in front of the stations tend to be larger, with 26 blocks in the largest two size ranges in the 2010s, compared to ten behind the station. In both eras, neighbourhoods behind the station have a larger proportion of small blocks, with 252 per cent more blocks behind the station in the three smallest size ranges in the 1880s, and 216 per cent more in the 2010s. A large number of small blocks have been replaced in front of the station, as the riverfront has been redeveloped.

The contrast in morphology between the front and the back of the stations is evident in the 2010s, but has become less exaggerated. The neighbourhoods behind the stations are now characterised by post-war residential estates, but block size is only part of the picture.

Spatial analysis

Network change

Overlaying the pedestrian networks for the South Bank and Lambeth for the 1880s and 2010s, in Figure 7.9, reveals extensive change. While the street pattern has remained relatively stable to the north-west of the station, this is not the case along the river or behind the station. The most obvious alteration is the introduction of access to the riverfront, which in the 1880s was blocked by river wharves. Before the wharves were demolished and replaced, a process which took place between the 1920s and the 1980s, there was no river path at all. Removal of the wharves eliminated many of the street which ended at the water. Pedestrian access to the riverfront became possible only after the Second World War, when the large, public developments that followed the 1951 Festival of Britain opened up the first sections of the new Thames Path, which now connects Lambeth Bridge to Blackfriars Bridge and beyond. Several new public spaces were also introduced along the riverfront, creating a new network of paths connecting inland towards Waterloo Station. These changes affected the street network equally in front of the station and behind. The riverfront could be seen as a separate zone, orientated towards the Thames rather than the station.

In the South Bank area there has been relatively little change beyond the riverfront, with a grid of streets north and south of Waterloo East Station little altered. Although self-contained estate layouts were introduced at Peabody Square and Webber Row, these changes were made early, the former in 1871 and the latter in 1906. The other area of change is found immediately in front of Waterloo at what is now the IMAX (Waterloo) Roundabout. Here a space was cleared in front of the station with the demolition of terraced streets during the first half of the twentieth century, eventually making way for the current roundabout and subway system in the 1960s.

In Lambeth, a similar roundabout system was introduced where Westminster Bridge Road passes from the Thames beneath the Waterloo approaches. Streets were also demolished in the 1960s to allow the rebuilt St. Thomas's Hospital to occupy a larger site. A new public space, Archbishop's Park, had opened in the grounds of Lambeth Palace in 1901, providing public access to an area previously off-limits.

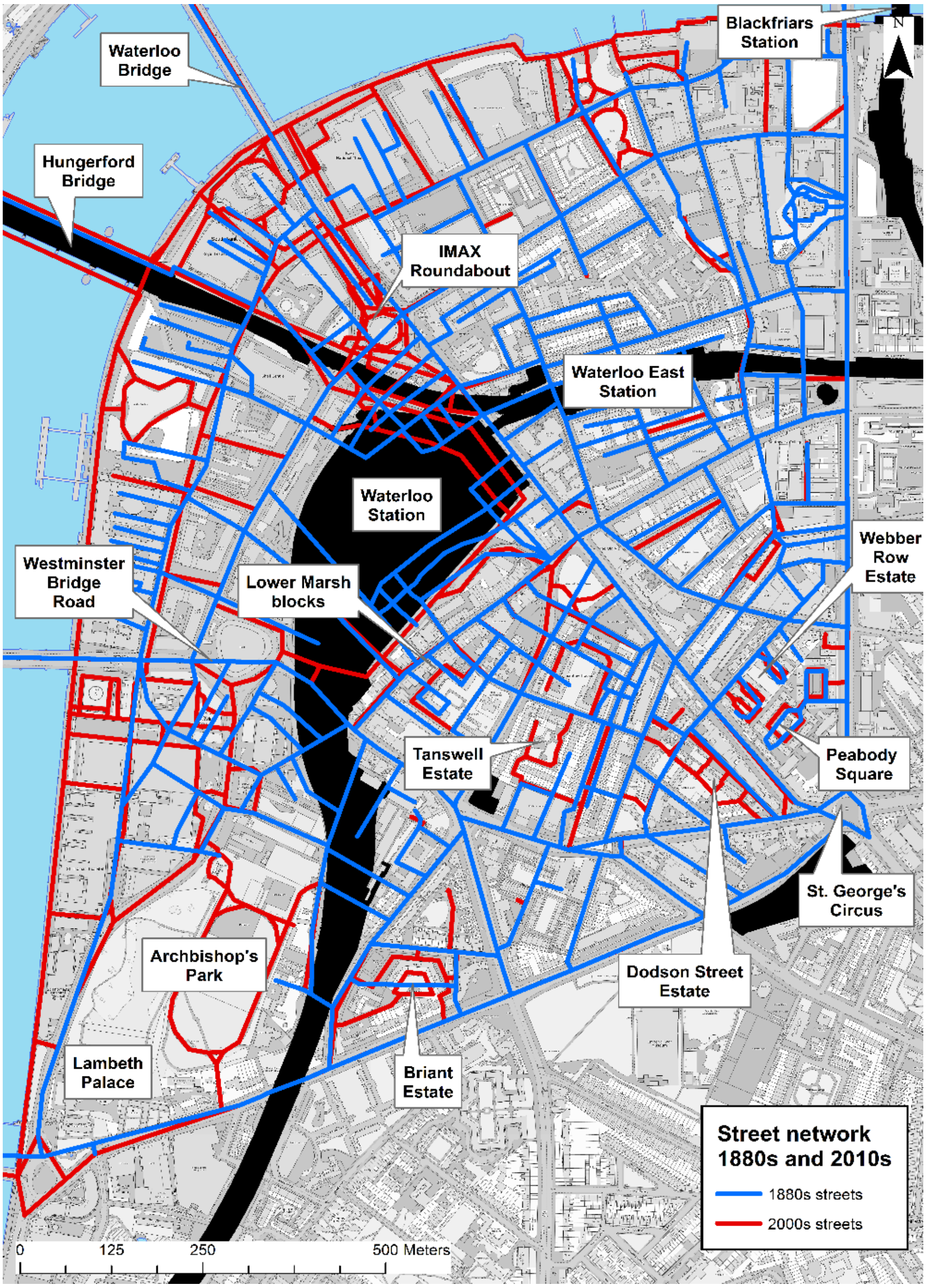

Figure 7.9: Street network 1880s and 2010s.

Image 7.4: Grindal Street dead end, off Lower Marsh.

Behind the station in Lambeth there was substantial reconstruction of the street network east of Waterloo. Here several estates were built between the 1950s and 1980s, replacing Victorian terraced streets and, in the case of the Tanswell Estate, a series of large mansion blocks (the Campbell Buildings) dating from the 1890s. The Briant Estate, the Dodson Street Estate, the Tanswell Estate and stand-alone blocks off Lower Marsh all introduced segregated layouts, with systems of alleys, dead-ends (Image 7.4) and streets closed with vehicle barriers, with the effect of discouraging casual pedestrians.

Table 7.1 analyses and compares neighbourhoods either side of the station. The data shows that since the 1880s total segment numbers have increased by 16 per cent in neighbourhoods in front of the stations, but by 44 per cent in areas behind. At the same time, mean segment length has decreased by a greater proportion behind the stations: by 22 per cent compared with 10 per cent in front. Dead ends form a greater proportion of the network in Lambeth than in the South Bank – 2.6 per cent compared to 0.3 per cent. This is a reversal of the situation found in the 1880s, when 2.6 per cent of the network in South Bank consisted of dead ends, and only 1.6 percent in Lambeth.

	Total number of segments	Mean segment length (m)	Dead ends as percentage of total segments
Station front areas			
South Bank 1880s	627	51	2.6%
South Bank 2010s	728	45	0.3%
Percentage change	**16%**	**-10%**	**N/A**
Station back areas			
Lambeth 1880s	814	53	1.2%
Lambeth 2010s	1173	41	2.6%
Percentage change	**44%**	**-22%**	**N/A**

Table 7.1: Street network data South Bank and Lambeth, 1880s and 2010s.[58]

There are now many more segments behind Waterloo than in front, these segments are shorter and more of them are dead ends. The street network has changed differently either side of the station. The proportionately greater scale of change found behind Waterloo is indicative of a transformation that replaced much of the nineteenth street layout with a more complex, self-contained and separated network.

Space syntax analysis

Choice at 3000m has been mapped for the wider Waterloo area for the 1880s and 2010s. A comparison between Figures 7.10 and 7.11 show the network of high Choice routes in the Waterloo area fundamentally unaltered since the 1880s. Through routes radiated, both then and now, from St. George's Circus. Each of the four main streets which passes through the Waterloo area connect to a river crossing: Lambeth Road to Lambeth Bridge, Westminster Bridge Road to Westminster Bridge, Waterloo Road to Waterloo Bridge and Blackfriars Road to Blackfriars Bridge. This wheel-like structure encloses wedge-shaped areas of lower Choice streets connected orthogonally with streets running parallel to the riverfront, with higher Choice values than their neighbouring shorter segments: York Road–Stamford Street, and

[58] Lower value of the two time periods shown in red, for ease of comparison.

Lower Marsh–The Cut. Waterloo Station was built on a site with high Choice routes running in front and behind, and medium Choice routes to either side.

The main alterations between the two periods are to the street network at the immediate front and back of Waterloo Station. As discussed above, new traffic systems were introduced at Waterloo Roundabout and on Westminster Bridge Road, and Choice values have fallen in both these sections, where new complexity has been introduced to through journeys. Choice values have also fallen on Lower Marsh, with Baylis Road taking over its role as the main north-south connection on the east side of the station. This change has coincided with the deconstruction of the street grid that previously surrounded Lower Marsh.

	Choice 3000m	Choice 800m	Choice 400m
Station front areas			
South Bank 1880s	622048589	13683566	1815316
South Bank 2010s	418943286	8633567	1230931
Percentage change	**-33%**	**-37%**	**-32%**
Station back areas			
Lambeth 1880s	570746776	11329793	1559828
Lambeth 2010s	335542032	8671228	1258332
Percentage change	**-41%**	**-23%**	**-19%**

Table 7.2: Mean Choice values for Waterloo, 1880s and 2010s.[59]

Choice values have fallen between the two periods across the three scales measured, and on both sides of the station. The pattern of changes is consistent in South Bank, where Choice has fallen by around a third at 3000m, 800m and 400m scales. This means that not only have journeys across the whole area become more difficult, but the same has occurred within the neighbourhood both at the 800m scale associated with a 10 minute walk, and at the 400m scale associated with very short local trips.

[59] Lower value of the two time periods shown in red, for ease of comparison.

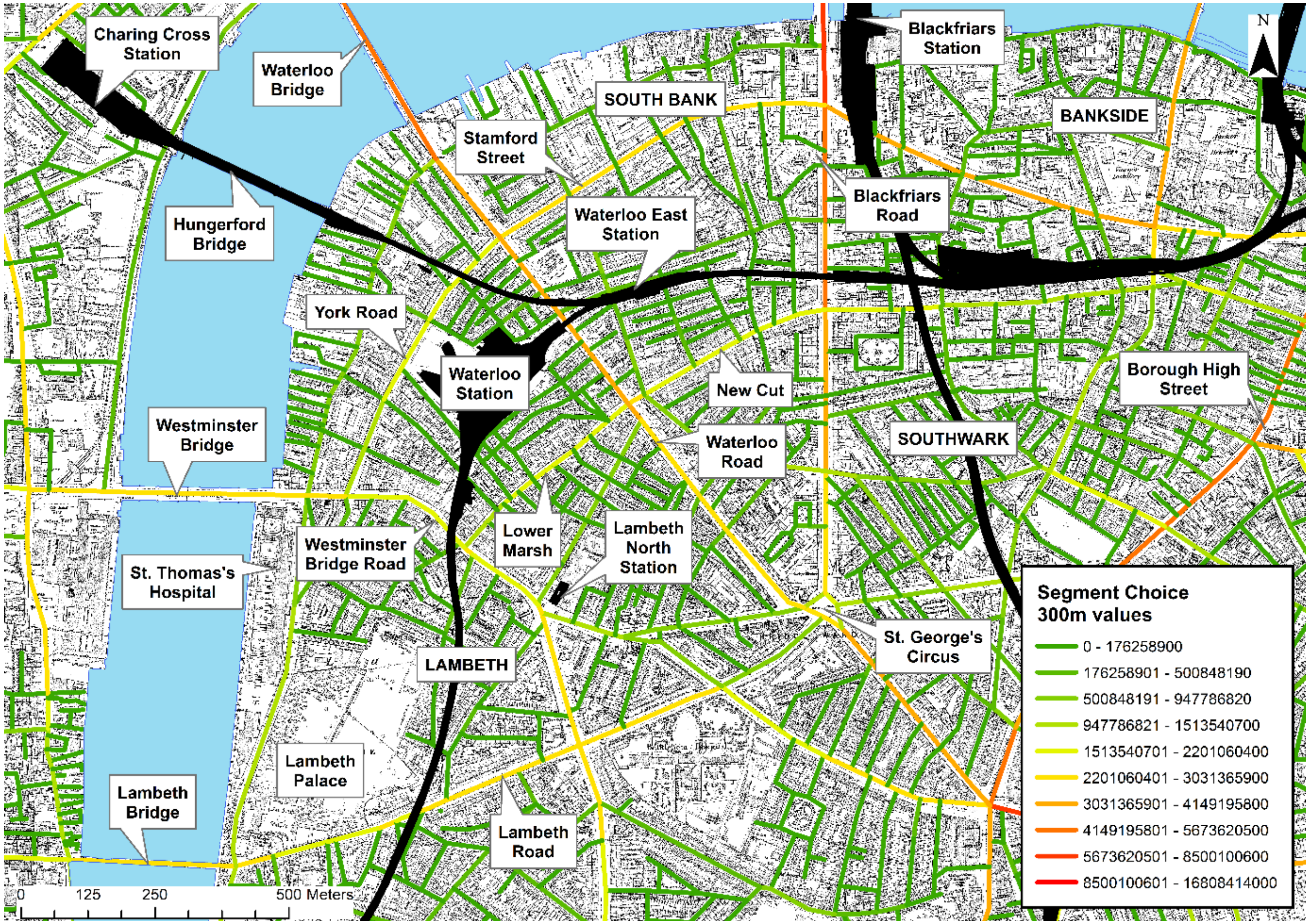

Figure 7.10: Choice 3000m Waterloo 1880s.

Figure 7.11: Choice 3000m Waterloo 2014.

Behind the station, in Lambeth, there has been a greater degree of reduction since the 1880s in Choice values at 3000m, but a smaller reduction at the other two scales. This suggests that journeys across the area have also become more complex, but that local through journeys remain on average easier behind the station than in front. The changes at 3000m scale may reflect the junction systems introduced on Waterloo and Westminster Bridge Roads. Access to the riverfront has not improved mean Choice values, as the river path is a relatively low Choice route.

The different degrees of reduction in neighbourhood scale Choice values have, in fact, evened out the disparities in mean Choice values found either side of Waterloo in the 1880s. Values are now similar on either side of the station, and the contrast between the two areas has disappeared. At 800m and 400m scales Choice values are now similar in both Lambeth and the South Bank.

Integration values at 800m scale also highlight the network of main streets radiating from St. George's Circus, both in the 1880s and today. In Figure 7.12 the most integrated segments are the longest, straightest roads: Blackfriars Road, Lower Marsh, The Cut and Waterloo Road. Highly integrated, shorter streets are also located in the grid based around these longer streets. A street grid fills the spaces between the 'wheel spokes' of Westminster Bridge, Waterloo, and Blackfriars Road. It is interrupted by Waterloo Station and the Charing Cross viaduct. Segments closest to Waterloo have low Integration values where the station breaks the grid connections. The viaduct, however, is less clearly associated with lower Integration. Streets that pass under the railway appear unaffected, retaining high Integration values. Integration is lowest along the riverfront between York Road-Stamford Street and the Thames, and in the area around the large, walled grounds of Lambeth Palace.

Figure 7.13 shows a similar basic pattern of Integration, but with some particular changes. The river path remains the least integrated part of the station area, but higher Integration values have spread to new routes between Waterloo and the Thames where South Bank cultural attractions have replaced wharves.

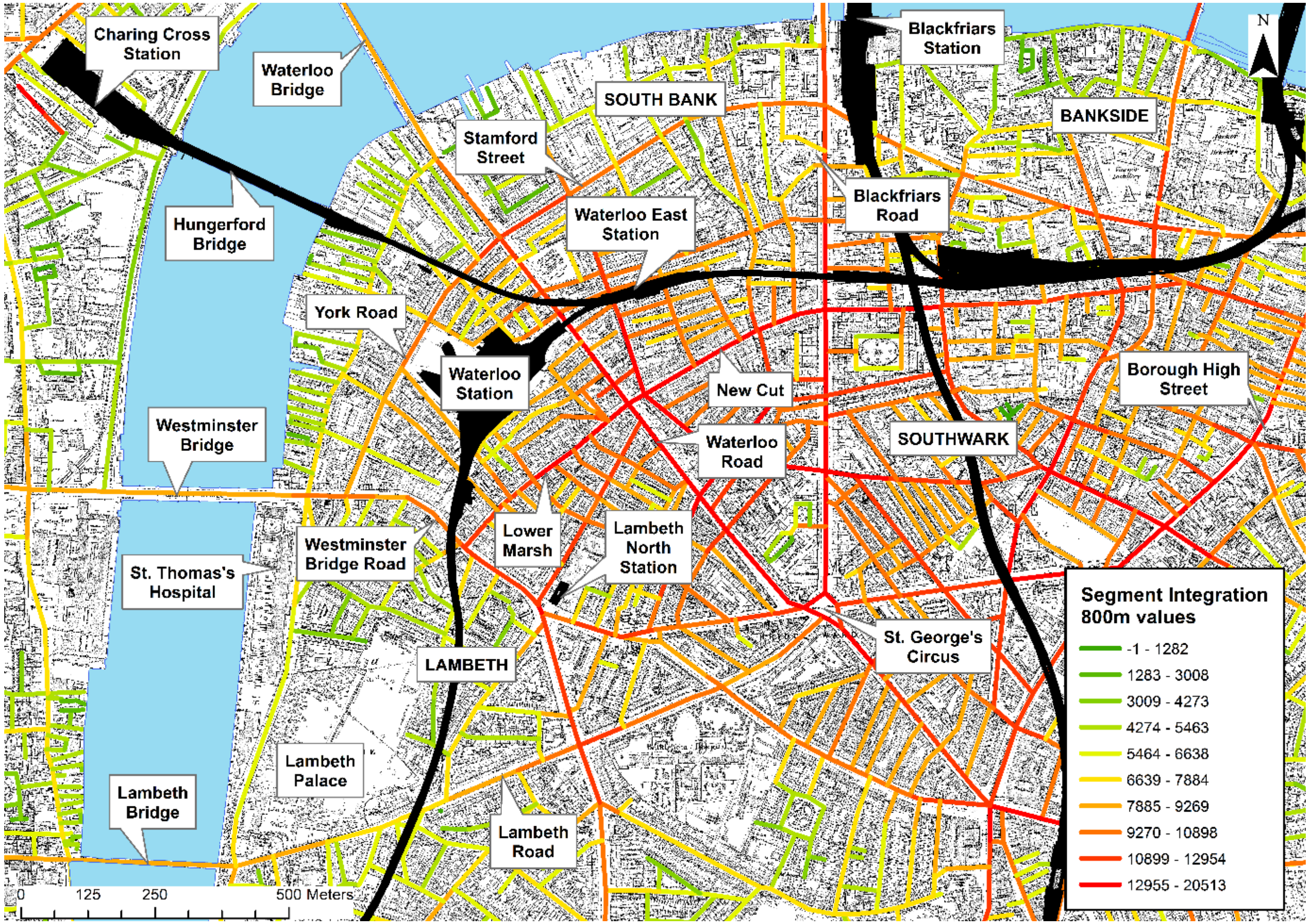

Figure 7.12: Integration 800m, Waterloo 1880s.

Figure 7.13: Integration 800m, Waterloo 2010s.

Post-war housing developments behind Waterloo, such as the Briant and Tanswell Estates, have introduced areas of lower Integration in place of the more evenly integrated streets grids they replaced. The main ‘spoke’ streets have retained much of their Integration value, but these have noticeably reduced on segments closest to the station. The sections of Westminster Bridge Road passing under the Waterloo approaches are no longer well-integrated, with both the more complex layout and the expanded viaducts changing the network configuration. Waterloo Road has also lost Integration value between the station and the river, north of Waterloo Roundabout. While Integration values on The Cut are unchanged, they have reduced on Lower Marsh, and the street now becomes less integrated, the further it passes behind the station.

	Integration 3000m	Integration 800m	Integration 400m
Station front areas			
South Bank 1880s	67406	8730	3108
South Bank 2010s	50988	6469	2273
Percentage change	**-24%**	**-26%**	**-27%**
Station back areas			
Lambeth 1880s	60851	7863	2824
Lambeth 2010s	44644	5984	2107
Percentage change	**-27%**	**-24%**	**-25%**

Table 7.3: Mean Integration values for Waterloo, 1880s and 2010s.

The figures above show that Integration values have consistently decreased by a quarter between the two periods, with little variation by either area or scale. This has resulted in mean Integration values that are similar on either side of Waterloo, but slightly lower across all three scales behind the station. This difference reflects the presence of lower Integration estate layouts behind the station, and the greater extent to which the 1880s grid has been dismantled in areas between the ‘spoke’ roads. Mean values reveal a comparable process of change occurring either side of the station, with an overall reduction in Integration as street layouts have become more complex and railway infrastructure more extensive.

Land use analysis

Retail uses in the neighbourhoods either side of Waterloo Station are shown in Figure 7.14 as they were in the 1880s. There were four main retail axes, to the south and west of the station. Blackfriars Road, connecting Blackfriars Bridge and St. George's Circus, had shops along its full length. The most concentrated area of retail was north of the junction with New Cut, interrupted only by railway building closest to the river, where Blackfriars Goods Station occupied the east side of the road; and north of St. George's Circus where Peabody housing had replaced a block on the west side of the road in 1871, replacing the Magdalen Hospital which fronted on to the main road. Blackfriars Road had other town centre buildings and uses in the 1880s, notably the Surrey Theatre on St. George's Circus and the Surrey Chapel at the New Cut junction, a Methodist chapel which became The Ring, a famous boxing venue.

The New Cut and Lambeth Marsh, running south-east – north-west, formed a long market street, interrupted by Waterloo Road. The New Cut was named when it was built in the early 1820s, a new route across open ground known as 'The Wild Marsh'. As the name Lambeth Marsh (and later Lower Marsh) also suggests, the South Bank was an area of wetland stretching from Blackfriars to Lambeth Palace – the entire area mapped above – with buildings found only along the embanked river wall until the late eighteenth century. Development began in the 1780s and the marshes were drained in stages, duck hunting land replaced with Georgian and early Victorian housing. The New Cut Market had become very popular by the mid-nineteenth century, and was described in 1849 by Henry Mayhew as "the largest, or rather most crowded" (along with the Brill in Somers Town – see Euston, King's Cross and St. Pancras analysis) of the fifteen or so weekend markets operating in London. Mayhew wrote that New Cut Market was "about half a mile in length, and… frequented by as nearly as possible 300 hucksters" (Mayhew, 1849). He paints a picture of streets so crowded that it was hard to move and of a working market with cheap goods and no frills: stalls lit only with horn lanterns or candles in hollowed out turnips, selling everything from apples, bloaters and offal to prints, herbal remedies and street dentistry. Mayhew concludes "Such, indeed, is the riot, the struggle, and the scramble for a living, that… the confusion and uproar of the New-cut on Saturday night overwhelms the thoughtful mind" (Mayhew, 1849).

The New Cut and Lower Marsh did not have the grander, high street buildings of Blackfriars Road, with the single exception of the Royal Victoria Hall (the Old Vic Theatre) on the corner with Waterloo Road. South of the New Cut junction Waterloo Road was also a focus for retail, but north of the junction the station interrupted the shop fronts.

Figure 7.14: Waterloo: retail 1880s, Integration 800m.

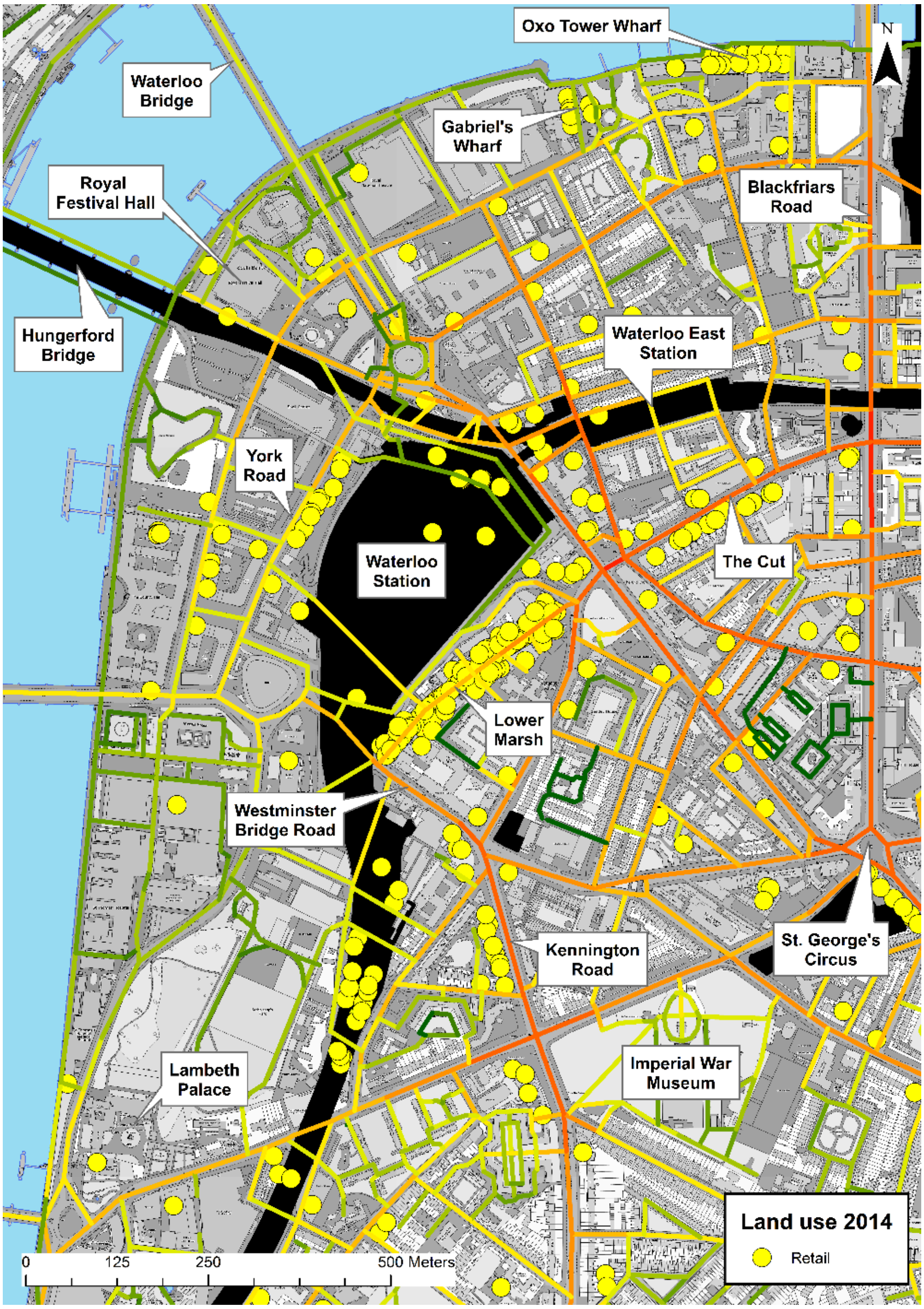

Figure 7.15: Waterloo: retail 2014, Integration 800m.

The other main retail artery in the area, Westminster Bridge Road, was lined with shops from the river to Lambeth North Underground Station, passing beneath the railway viaduct carrying the Waterloo approaches. It also hosted a number of other high street uses: Astley's Theatre, the Canterbury Theatre of Varieties, Gatti's-in-the-Road Music Hall, Lambeth Swimming Baths and the large Atkinson and Co. furniture and drapery department store. East of the tube station, the character of the street changed with large-footprint institutional uses replacing the shops, pubs and entertainment venues with Westminster Roman Catholic Cathedral, three further churches, and two large schools now found between Lambeth North and St. George's Circus.

By the 2010s there had been a substantial fall in the number of retail premises across the whole area surveyed. A total of 1388 shops in the 1880s had fallen to 479 by the 2010s, a reduction of 65 percent. This reduction masks different levels of change, with a 74 percent reduction in front of the station and a 57 per cent reduction behind.

Figure 7.15 shows only isolated retail premises in front of Waterloo, with a small cluster directly in front of station, another on The Cut and a third at the Oxo Tower Wharf. The main retail concentration is found behind the station on Lower Marsh, and only vestiges remain of the 1880s high streets. Blackfriars Road, Westminster Bridge Road and Waterloo Road have almost no shops, and on the New Cut are restricted to the block on the south side of the road nearest to Waterloo Road, much reduced from the 1880s market street. This level of change reflects the extent to which the built fabric of the Waterloo area has altered since the late nineteenth century. Heavily bombed during the Second World War, the riverfront then became the site of flagship post-war reconstruction with the Festival of Britain and subsequent South Bank arts investment. The function of the neighbourhoods north and west of Waterloo changed entirely, from industrial and wharf areas to London's cultural centre. During the 2000s restaurants, cafés and two shops opened around the Royal Festival Hall. These, with the earlier craft/retail developments at the Oxo Tower Wharf and Gabriel's Wharf, show how retail activity is found in pockets along the South Bank.

Blackfriars Road was largely rebuilt after the War, with large office blocks replacing much of the previous street-facing building stock. On Waterloo Road buildings around the junction with The Cut and Lower Marsh were demolished and replaced with public space. The changes on Westminster Bridge Road, however, were not entirely due to post-war change. The status of the street had begun to alter as the viaduct to Waterloo widened between the 1890s and the 1910s. Shops, pubs, offices and factories adjoining the railway lines to the west were demolished to make way for the railway, and the viaduct reached nearly its present scale, with only the Channel Tunnel rail link additions of the 1990s still to come. The bridge creates a dark tunnel, crossing and separating the street, which appears to have contributed to the erosion of Westminster Bridge Road's high street role. Post-war demolitions accelerated this trajectory, and shops on this street are now only found in isolated sections of remaining nineteenth century building stock.

Image 7.5: Lower Marsh market.

Behind the station, the Victorian buildings on The Cut were substantially destroyed and mostly replaced with housing that either did not face on to the street and/or did not incorporate mixed uses. Lower Marsh, by contrast, remained largely intact and its Victorian shops, with flats on floors above, are reflected in its continuing primary role as a shopping street (Figure7. 20).

Figure 7.16: Waterloo: commercial 1880s, Integration 800m.

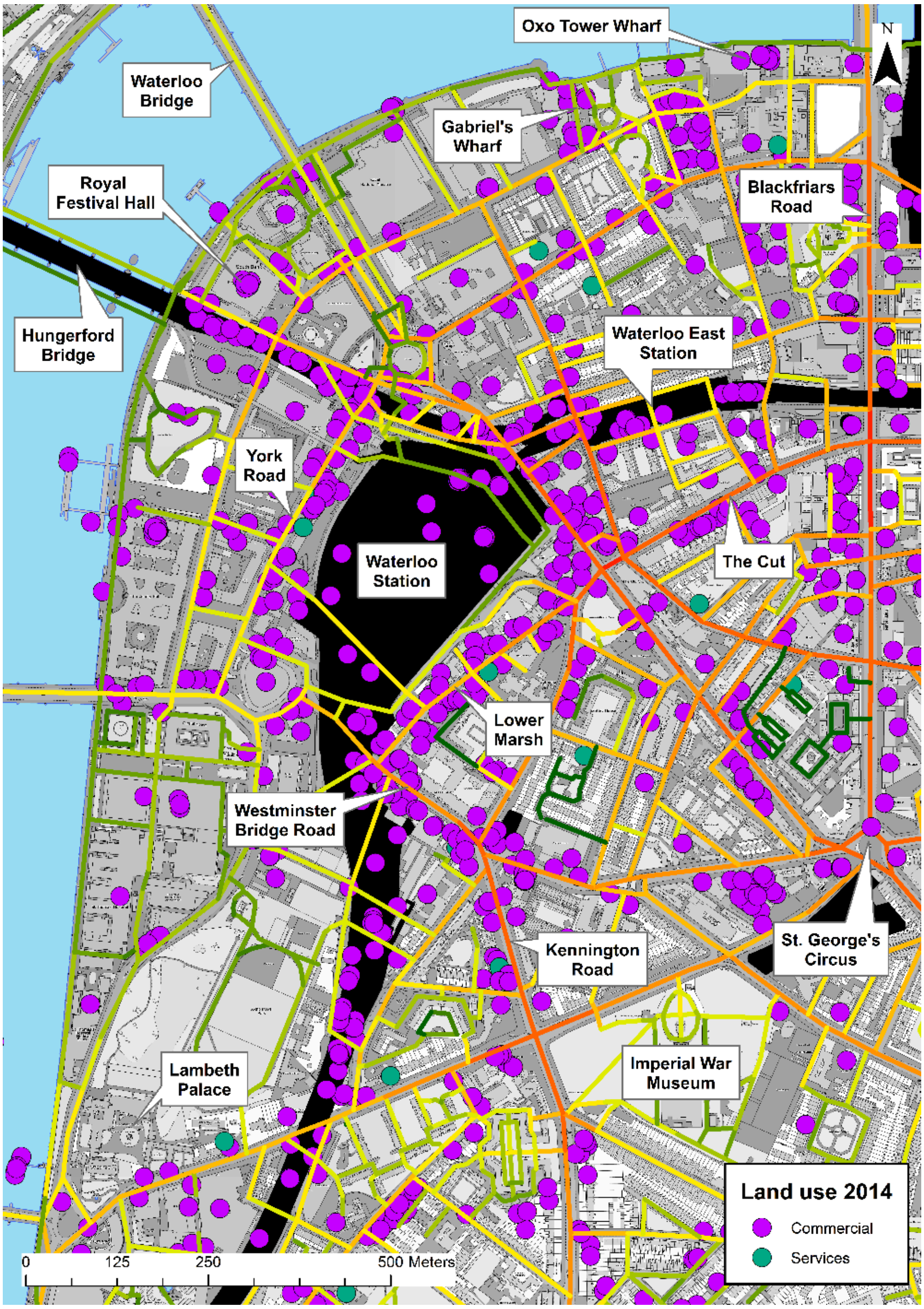

Figure 7.17: Waterloo: commercial 2014, Integration 800m.

Figures 7.16 and 7.17 show premises in the Commercial and the Services categories. Figure 7.16 reveals different characteristics in the 1880s main streets around Waterloo. Blackfriars Road had the main concentration of services in the area, ranging from solicitors to printers to undertakers. It was the predominant high street in the area, dominated by shops and businesses. Westminster Bridge Road also had similar services, but fewer than Blackfriars Road. New Cut and Lower Marsh had almost no offices or services, confirming their role as market streets. Offices were also found in areas in front of the station along the river, on Commercial Road, Belvedere Road and Stamford Street. These belonged to businesses connected to the wharves and the industrial premises along the Thames.

Land use		Count
Accommodation	1880s front	22
	2010s front	9
	1880s behind	2
	2010s behind	13
Eating	1880s front	48
	2010s front	21
	1880s behind	32
	2010s behind	22
Industrial	1880s front	335
	2010s front	118
	1880s behind	134
	2010s behind	12
Offices	1880s front	48
	2010s front	672
	1880s behind	10
	2010s behind	712
Public houses	1880s front	95
	2010s front	22
	1880s behind	65
	2010s behind	33

Retail	1880s front	788
	2010s front	155
	1880s behind	600
	2010s behind	299
Services	1880s front	141
	2010s front	12
	1880s behind	53
	2010s behind	10

Table 7.4: Waterloo non-residential land use count, 1880s and 2010s.[60]

By the 2010s, as Figure 7.17 shows, the number of offices had risen greatly. This overall scale of increase reflects working practices which are in many respects unrecognisable from those of the 1880s. Commercial premises are now found on all the streets dominated by retail in the 1880s, and on The Cut and Lower Marsh, where there were none in the 1880s. Offices are also now based in the railway arches on all sides of Waterloo, and these spaces form a series of clustered locations that rival the main streets of the area for land use density. These arches were less intensively occupied during the 1880s, generally used for warehousing and storage. Some have now been converted specifically for office use, while others host an extensive range of commercial premises, including garages, taxi firms, boxing gyms, picture-framers, theatres, restaurants and pubs.

	Mean Choice 3000m	Mean Integration 800m
1880s front of stations	959694967	10122
2010s front of stations	501378057	7306
Percentage change	**-48%**	**-28%**
1880s behind stations	913625019	9549
2010s behind stations	634905973	6867
Percentage change	**-31%**	**-28%**

Table 7.5: Waterloo non-residential land use values, front of stations, 1880s and 2010s.[61]

60 Lower value of the two time periods shown in red, for ease of comparison.
61 Lower value of the two time periods shown in red, for ease of comparison.

Table 7.4 shows that the number of office premises has risen on both sides of the station, but by an even greater proportion in areas behind the station – 7,020 per cent – than in front – 1,300 per cent. This trend is reflected in other categories – Accommodation, Eating, Pubs, and Retail – which were found in greater numbers in front of the station in the 1880s. By the 2010s the balance in all these has shifted, with more now found at the back of the station.

Table 7.5 shows spatial values for non-residential land use types between the 1880s and 2014 in neighbourhoods either side of Waterloo Station.

The mean spatial change for non-residential land uses is similar either side of the station. Mean Choice 3000m values and Integration 800m values have both declined. The only notable difference in patterns in the greater decline in mean Choice values in front areas. Land uses in front now have a lower overall mean Choice value that streets behind, a reversal of the position in the 1880s. This shift is attributable to the reconfiguration of use types in riverside areas, as discussed further below.

Table 7.6 shows mean density for all non-residential land uses. The density of non-residential uses has fallen in front of the station but has risen behind, confirming that different patterns of land use change have taken place in the two areas. The increase in density in front of the station is nearly three times as large as that behind.

The total number of uses has decreased by a greater proportion behind than in front, and there are now more individual land uses in front of Waterloo. Mean segment length per use has increased on both sides of Waterloo, which would be expected alongside a fall in the total number of uses. However, the fall has been greater in front areas. This suggests that the reconfiguration of the street network has been more extensive in front of the stations, resulted in a proportionately greater thinning out of uses than behind the station, with potentially greater segregation impacts than are now found behind Waterloo. The focus of land uses has evened out, moving away from front areas and towards back areas.

However, the Shannon Diversity Index shows a greater fall in land use diversity behind Waterloo than in front, suggesting that change since the late nineteenth century is more complex. The redevelopment of riverside wharves and industry in front areas has been accompanied by a fall in diversity, similar to that found in comparable riverfront areas at London Bridge. Meanwhile, the fall in diversity in back areas is greater than in London Bridge back areas, perhaps reflecting a greater mixture of types of industry and business in 1880s Lambeth compared with Bermondsey.

	Total non-residential uses	Mean uses per segment (weighted by segment length)	Mean segment length per use (m)	Shannon Diversity Index
1880s behind stations	1601	4.6	24.5	1.4
2010s behind stations	1121	6.8	37.5	1.1
Percentage change	**-30%**	**49%**	**53%**	**-26%**
1880s front of stations	984	7.0	19.7	1.2
2010s in front of stations	1207	2.7	33.3	0.1
Percentage change	**-23%**	**-61%**	**69%**	**-19%**

Table 7.6: Waterloo non-residential land use density, 1880s and 2010s.[62]

[62] Lower value of the two time periods shown in red, for ease of comparison.

Social analysis

Social analysis has been carried out for the Waterloo neighbourhoods, using separate methods for the late nineteenth century and for the early twenty-first century. Figure 7.17 shows the 1898 Booth map of Waterloo. The Booth map shows that all the neighbourhoods surrounding Waterloo Station were relatively poor, with a similar social profile to that found in the adjoining neighbourhoods surrounding London Bridge Station.

Figure 7.17 shows that a single building in the survey area, Lambeth Palace, fell into Booth's wealthiest 'Yellow' category. Middle class housing in the 'Red' category was located exclusively on the area's high streets: Blackfriars Road, New Cut, Waterloo Road and Westminster Bridge Road.

The full range of Booth categories below Red, from Pink to Black, was found in the wedge-shaped neighbourhoods contained between these main streets. Along the full length of the South Bank the riverside block was non-residential, marked grey on Booth's map and occupied by factories and wharves. These ranged from the Lion Brewery on the riverfront beside Hungerford Bridge, to "Sainsbury's the provision merchants" (Booth, 1902, B363, p. 67) whose warehouses took up an entire street near Blackfriars Bridge. St. Thomas's Hospital filled the entire riverfront between Westminster Bridge and Lambeth Bridge.

Streets closest to the station were places of exchange. The York pub on York Road was known as "Poverty Junction or Out at Elbows Corner" (Booth, 1902, B363, p. 33) and was the place where "the poorer music hall artists loaf in hope of a job" from the agents based on the street (Booth, 1902, B363, p. 33). The more common form of exchange, however, was clearly prostitution. Booth's surveyor described Tennison Street, the main access road at the front of the station, as notable for having "very few prostitutes' apartments" (Booth, 1902, B363, p. 33). York Road, on the other hand, had many hotels which were "little else than brothels" (Booth, 1902, B363, p. 37). The same situation was found east of the station on Stamford Street which had "a great many prostitutes living here" (Booth, 1902, B363, p. 55). The survey concludes that "Prostitutes crowd around Waterloo as they do round St. Pancras and King's Cross, and the York Road has much the same reputation as the Euston Road" (Booth, 1902, B363, p. 45). Where there were stations, prostitution was also expected.

Figure 7.18: Waterloo 1898, Charles Booth Survey map.[63]

[63] Source: Charles Booth Online Archive, London School of Economics. Labels added for the purposes of this study.

The lowest categories of poverty could be found both in front of Waterloo and behind, in crowded courts and back streets off the main road. Poor courts off Waterloo Road, such as Salutation Place, provided rooms at cheap rents that “used to be fine some years ago” (Booth, 1902, B363, p. 47) but now have “no washhouse nor copper [for heating water]” (Booth, 1902, B363, p. 49). A resident, who blamed the conditions on the landlord, the Prince of Wales, commented “He should give us coppers, it lays us all up with bronchitis being without them” (Booth, 1902, B363, p. 49). The survey recounted a grimly illustrative tale of conditions on Cornwall Road where “last Saturday in one of these houses a woman threw a lighted lamp at her husband and both were burnt to death” (Booth, 1902, B363, p. 43).

Behind the station poor housing and factories were found in very close proximity, for example on Upper Marsh which had “Field’s soap works on S side; some very poor houses on N side” (Booth, 1902, B363, p. 191). The survey notes the “very poor and rough” area (Booth, 1902, B363, p. 45) north east of the junction of Waterloo Road and Stamford Street which, along with much of the district, had not changed in the ten years since the first survey. However, the majority of streets around Waterloo remained “fairly comfortable” (Booth, 1902, B363, p. 45), and Booth’s surveyor noted that the only substantial changes to any of the areas around the station were those caused by demolitions around Lambeth Marsh to extend the station and to build the Waterloo and City Line.

Immediately in front of Waterloo, between the station and the junction of Waterloo Road and York Road, was an area of five small, terraced streets which were eventually demolished as the station expanded. The Booth surveyor reports that these were dominated by the proximity of the station, with Robert Street for example having very few residents, only railway “firemen and foremen” (Booth, 1902, B363, p. 31) Streets closest to the south-east side of the station were also home to railway workers with. Aubin Street inhabited by railway porters, apparently “known for the amount they drink” (Booth, 1902, B363, p. 29).

Between Lambeth Marsh and the station, there were streets in poor repair. Granby Place had broken windows, chickens in the street and poorly dressed, dirty inhabitants. Built in 1851, “the west side is coming down for railway extension” (Booth, 1902, B363, p. 29). All the streets between Lambeth Marsh and Waterloo were eventually demolished as the station grew. Railway works also effected streets in front of the station, on the east side of Waterloo Road. Alaska Street was “blocked by operations for widening the railway bridge”, (Booth, 1902, B363, p. 57) and on Brad Street where there were “notices to quit when wanted being served” (Booth, 1902, B363, p. 61) so the south side of the street could be demolished for viaduct widening.

A similar situation was found beside the Waterloo approach viaduct, south of the station. Where the viaduct had been widened, Homer Street and other roads passing under the viaduct had lost “a large bit of the end of these streets” (Booth, 1902, B363, p. 199). Heathfield Place had just been demolished by the London and South Western Railway Company (L&SWR) and Shrub Place had only two houses left. A resident of the latter complained although the SER[64] had built replacement housing, “They don’t want us in… they turn us out again the moment we are in arrears with our rent” (Booth, 1902, B363, p. 193). The viaduct system was far from static, and the threat of future clearance came with proximity to the arches.

Booth’s surveyor concluded that the “wedge” between Blackfriars Road and Waterloo Road, having improved, was now “getting poorer” (Booth, 1902, B363, p. 81). The area included patches of extreme poverty, the worst being Joiner Street opposite the Bethlehem Asylum (now the Imperial War Museum), a street of “thieves and prostitutes” (Booth, 1902, B363, p. 15). Recent decline was ascribed to demolitions, both clearances for new housing and railway demolition. “Railway clearance and increased facilities have driven out the dark blue and carried off the pink: the dark blue has sought refuge in the streets nearest to those from which they were driven, while the pink has found house room further afield” (Booth, 1902, B363, p. 81). In other words, the poor had no choice but to stay, while the better off are able to leave.

Booth’s surveyor also drew conclusions about the particular character of the Waterloo neighbourhoods, noting that unlike districts north of the Thames most of the inhabitants both lived and worked in the area. The survey called them “one vast poor family whose lives are well known to one another” (Booth, 1902, B363, p. 81) and noted that “while this is a poor area, all the children are remarkable for their clean faces” (Booth, 1902, B363, p. 9). The centre and meeting place for the neighbourhood was the “New Cut and Lambeth Lower Marsh Market” (Booth, 1902, B363, p. 81) which as busy at night with fish, meat, produce and flower stalls. The social composition of the Waterloo areas was summed up by the Booth survey observation “Top hats rarely to be seen: bowlers, soft felt hats and caps the usual head gear” (Booth, 1902, B363, p. 25).

Table 7.7 shows segment and spatial data for Waterloo, related to the Booth classifications and divided between the front and back of the station. In 1898 the proportion of segments in the Red category was very similar in both areas. However, the lower the Booth category

[64] The interviewee was wrong about the company – it was actually the L&SWR.

the greater the difference between the two areas. A higher proportion of street segments in front of Waterloo were in the Black, Dark Blue, Light Blue and Purple categories than behind the station. These segments were also systematically longer on average than in the same categories behind Waterloo. On average there were more 'middle class' and 'fairly comfortable' streets behind Waterloo than in front, and these streets were shorter. There were a larger number poorer streets in front of the station, and they were on average longer.

		Count	Percentage of total segments	Segment Length
Red: middle class	**Front**	347	25.7%	57
	Back	489	29.8%	57
Pink: fairly comfortable	**Front**	536	23.6%	62
	Back	649	34.2%	55
Purple: mixed	**Front**	684	30.1%	62
	Back	425	22.4%	50
Light Blue: poor	**Front**	379	16.7%	55
	Back	219	11.5%	51
Dark Blue: very poor	**Front**	197	8.7%	61
	Back	66	3.5%	44
Black: lowest class	**Front**	126	5.6%	63
	Back	50	2.6%	51
Population mean	**Front**	N/A	N/A	60
	Back	N/A	N/A	54
n=	**Front**	2269		
	Back	1900		

Table 7.7: Mean spatial data and Booth, Waterloo, 1898.[65]

[65] Lower value of the two time periods shown in red, for ease of comparison.

The spatial values for the Waterloo segments reveal a similar picture. Comparisons between mean values either side of the station fall within a 95 per cent confidence interval for all categories, with the exceptions of Light Blue for Choice 3000m and Dark Blue for both Choice and Integration vales. Choice 3000m and Integration 800m values are lower for streets behind the station in almost all categories. There is a single exception: the poorest streets, those in the Black category, have substantially higher mean Choice 3000m values behind the station than in front. Again, the pattern of higher spatial values associated with the lowest poverty category matches Vaughan and Geddes' (2009) findings, and may reflect a similar "fine grain of poverty and relative prosperity cheek by jowl" (Vaughan and Geddes, 2009, p. 23), with the poorest streets often a single turn from the wealthiest.

Overall, the pattern of difference between front and back reflects the better integrated, higher Choice profile of the longer streets found on average in front of Waterloo. The spatial difference between the two areas was not, however, mirrored by a corresponding social difference in the late nineteenth century. While the streets behind Waterloo had lower mean Choice and Integration values and were more segregated, it was the streets in front of the station that were, on average, poorer.

Figure 7.19 shows the GLA Household Income Estimates mapped for LSOAs surrounding Waterloo Station for 2007/8. The map shows that there were no LSOAs in the Waterloo neighbourhoods in the highest five GLA income brackets. In 2007/08 the Waterloo area was still relatively poor, as it has been in the 1890s, with mean income levels still in contrast to those found on the opposite bank of the Thames (see Victoria Station section for analysis of Pimlico). The range of incomes represented in the Waterloo area appears to have reduced since the 1890s.

The overall picture in Figure 7.19 of Waterloo as, on average, a lower income area, is valid. Nearly all of the station neighbourhoods fall into the second and third lowest income categories. Only part of one LSOA in the lowest income bracket is found in the analysis area – an area covering the Southwark Estates. Much of the Waterloo area falls into the second lowest income category (£38,670 - £45,850 p. a.) including all the areas where mid-twentieth century social housing estates replaced Victorian streets and blocks. Areas on the riverfront fall into the third lowest income category (£45,851- £51,310). These include the largest remaining area of Victorian street layout and housing, to the north west of Waterloo. They also cover the redeveloped former wharf areas, which although primarily non-residential include blocks of riverside flats. The exception is the Coin Street Co-Operative, east of Waterloo Bridge, developed as a residential area among the offices from the 1980s onwards.

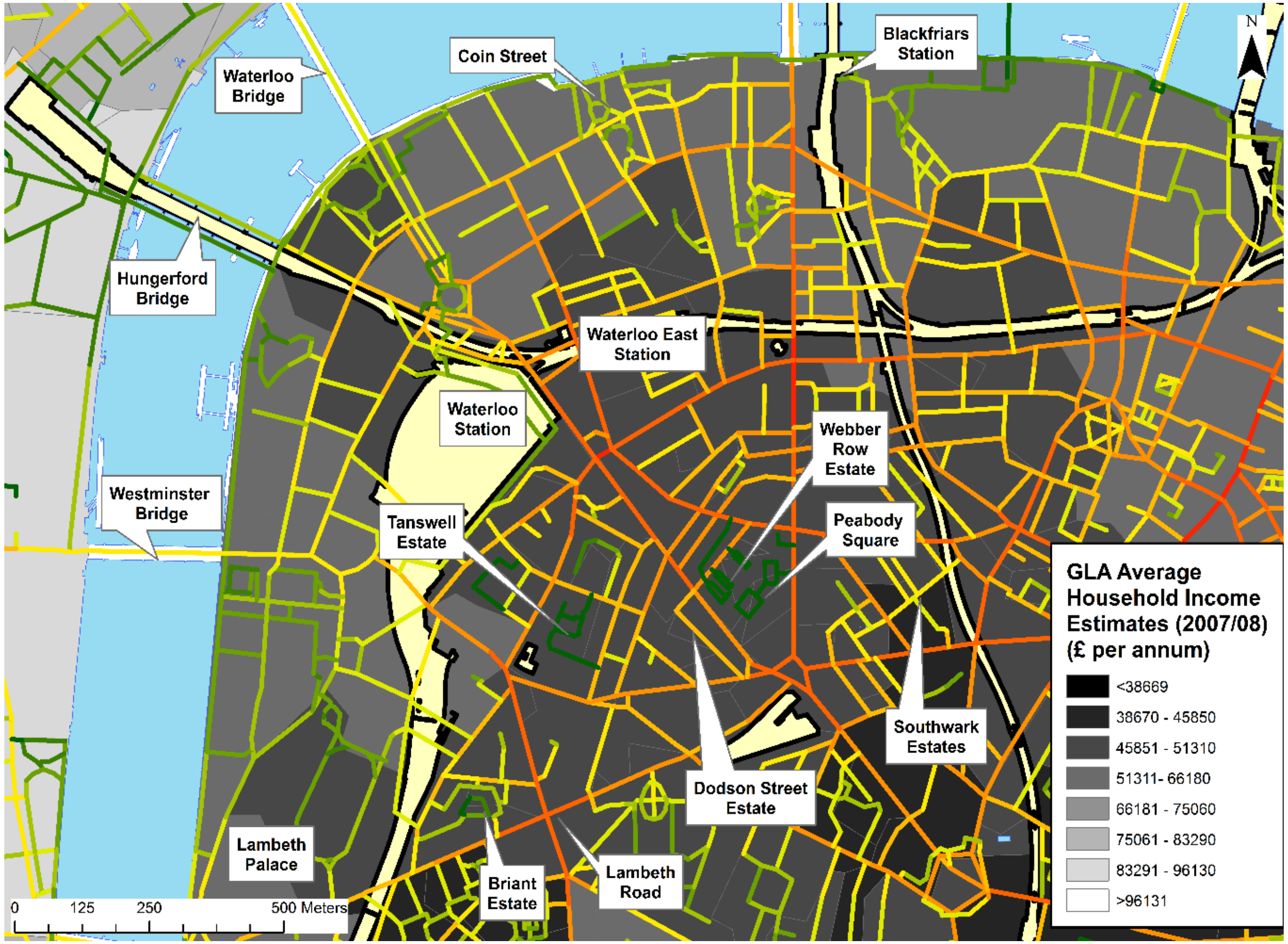

Figure 7.19: Waterloo, GLA Household Income 2007/08, Integration 800m.

Mean household income estimate	Neighbourhood	Count	Percentage of total segments	Mean Segment Length
£45,851-£51,310	**Front**	178	13.5%	43
	Back	208	15.8%	49
£38,670-£45,850	**Front**	428	32.4%	58
	Back	489	37.1%	60
<£38,669	**Front**	16	1.2%	65
	Back	0	N/A	N/A

Table 7.8: Waterloo, GLA Household Income 2007/08 with segment data.[66]

Only three estimated income bands are found in the Waterloo neighbourhoods. Almost all the street segments in the Waterloo area fall into the top two of the three income categories shown above, with a very small number in the lowest category. Proportions are comparable either side of the station, and the only substantial difference between areas is the average segment length for the highest income LSOAs, which is shorter in front of Waterloo. This is likely to reflect riverside development which has added more, shorter segments through the creation of small parks as breaks in the river frontage.

Table 7.8 shows that both Choice 3000m and Integration 800m values are higher in front of the station than behind for both the comparable income categories. The better integrated segments in front of the station reflect the pattern of difference found in the 1890s. It is also notable that where there are segments in the lowest income category, in front of the station, they have higher Integration values than the two categories above. This pattern also reflects the higher values found for Booth's lowest income band in 1898.

The social profile of the Waterloo neighbourhoods has become a little less extreme since the late nineteenth century, with the lowest income group less apparent in the analysis area. However, there has also been a retreat at the highest end of the scale, with fewer high income categories found than in the Booth survey. Unlike some other London terminus areas, the railway does not delineate a separation between areas of high and low income. The viaducts do not appear to divide the area in social terms.

[66] Lower value of the two time periods shown in red, for ease of comparison.

Discussion and conclusions

Waterloo Station is an incomplete project that has become permanent through simple longevity. Built in a stand-by location as a temporary solution, it is still operating 150 years later. Its limitations as a station are evident from its position within an extensive network of connections which cannot be directly accessed. Despite attracting more passengers than any other station in Britain, Waterloo is poorly integrated into the London transport network. It status as a fall-back option led to unplanned, piecemeal development to an even greater degree than at other London terminals. The expansion of Waterloo caused particular destruction in immediate streets during the late nineteenth century. The station brought not only demolition but also transient activities, principally prostitution, to one of the poorest areas of central London. The area appeared blighted during the time of the Booth Survey.

However, both the South Bank and Lambeth have undergone particularly extensive change since the late nineteenth century, fundamentally altering the character of the place. The docklands redevelopment associated with East London began on the South Bank where riverside industry went into rapid retreat between the wars and vanished entirely by the late 1970s. The comprehensive redevelopment and opening up of the riverfront created a new neighbourhood between Waterloo and the Thames, a destination but not a local centre. Meanwhile the local prominence of areas behind the station declined as the fine grain of small premises for shops and business was replaced by larger blocks built for corporate occupation.

There is a clear difference between the economic fortunes of streets either side of Waterloo. The decline of Westminster Bridge Road pre-dates the wider redevelopments of the 1960s, and the streets seems to have suffered from the increasing separation imposed by the widening Waterloo approach viaduct. Elsewhere, a number of small estates, built mostly on former industrial sites behind the station, replaced a many-layered pattern of uses with mono-use areas of housing, characterised by complicated, disconnected street layouts. On both sides of Waterloo remaining stretches of Victorian streets, with shops at ground level and flats above, are where the principal concentrations of non-residential uses are to be found. The only locations that can compete for density are the railway viaducts, which provide a particularly local type of accommodation in demand from an increased range of businesses.

Unlike some other London terminus areas, the railway does not delineate a separation between areas of high and low income. The South Bank and Lambeth remain relatively poor, but the viaduct system does not appear to divide the area in social terms. Despite the more extensive estate development found behind the station, in contrast with the Victorian street patterns retained between Waterloo and Blackfriars Roads, the social dividing line found behind stations served by approaches in cuttings or at grade is no apparent at Waterloo.

Spatial values have converged over time between the two sides of the station, and it is now more difficult to trace spatial contrast than it was in the 1880s. Streets close to Waterloo have suffered from a reduction in Choice and Integration as the station has grown, changing their network status. However, the viaducts that cross the South Bank and Lambeth from all directions integrate well with the streets that pre-dated them. While the local impact of a particularly wide viaduct can be damaging, the viaducts seem to create a permeable boundary while contributing valuable extra space that is proving increasingly popular. The social and economic characteristics of the Waterloo area are most similar to those found in the London Bridge Station neighbourhoods, which share many spatial characteristics with Waterloo as well as forming part of the same viaduct network.

The final analysis chapter covers Victoria Station, completed nearly fifteen years after Waterloo opened.

Chapter Eight: Victoria Station

Introduction

Victoria Station is located on the south-western edge of central London between the River Thames and Hyde Park, Green Park, Buckingham Palace and St. James's Park, as illustrated in Figure 8.1. This chain of green spaces creates a natural barrier between the neighbourhoods that surround the station and central London. Three neighbourhoods adjoin the station: Belgravia to the west, Pimlico to the south-east and Westminster to the east and north-east. A ninety-degree band in the course of the Thames forms the southern and eastern edges of Pimlico and Westminster.

Victoria Station is a terminus for railway services to Hampshire, Kent, Sussex and south London. Approach lines run to the station from the south, crossing the Thames and creating an area of separation between Pimlico and Belgravia. Railway lines, sidings and railway buildings occupy a 1.25km strip from the station frontage at Victoria Street to Grosvenor Bridge, which carries the railway over the river. This area ranges in width from 130m to 290m and is crossed by only four routes – three road bridges, and Grosvenor Road along the riverfront, which is bridged by the railway. The width of the approaches close to the Thames is used to contain extensive sidings and train sheds as well as the mainline tracks themselves.

History

The railway follows the line of what was a tidal creek which flowed through marshy land crossed by drainage ditches. This inlet was developed by the Chelsea Waterworks Company in 1722 to feed reservoirs in Green Park. In 1823 the landowner, the Earl of Grosvenor, converted the creek into a commercial canal. Grosvenor Basin was dug out at the head of the canal, now the site of Victoria Station. Figure 8.2 shows the area shortly after the canal's completion.

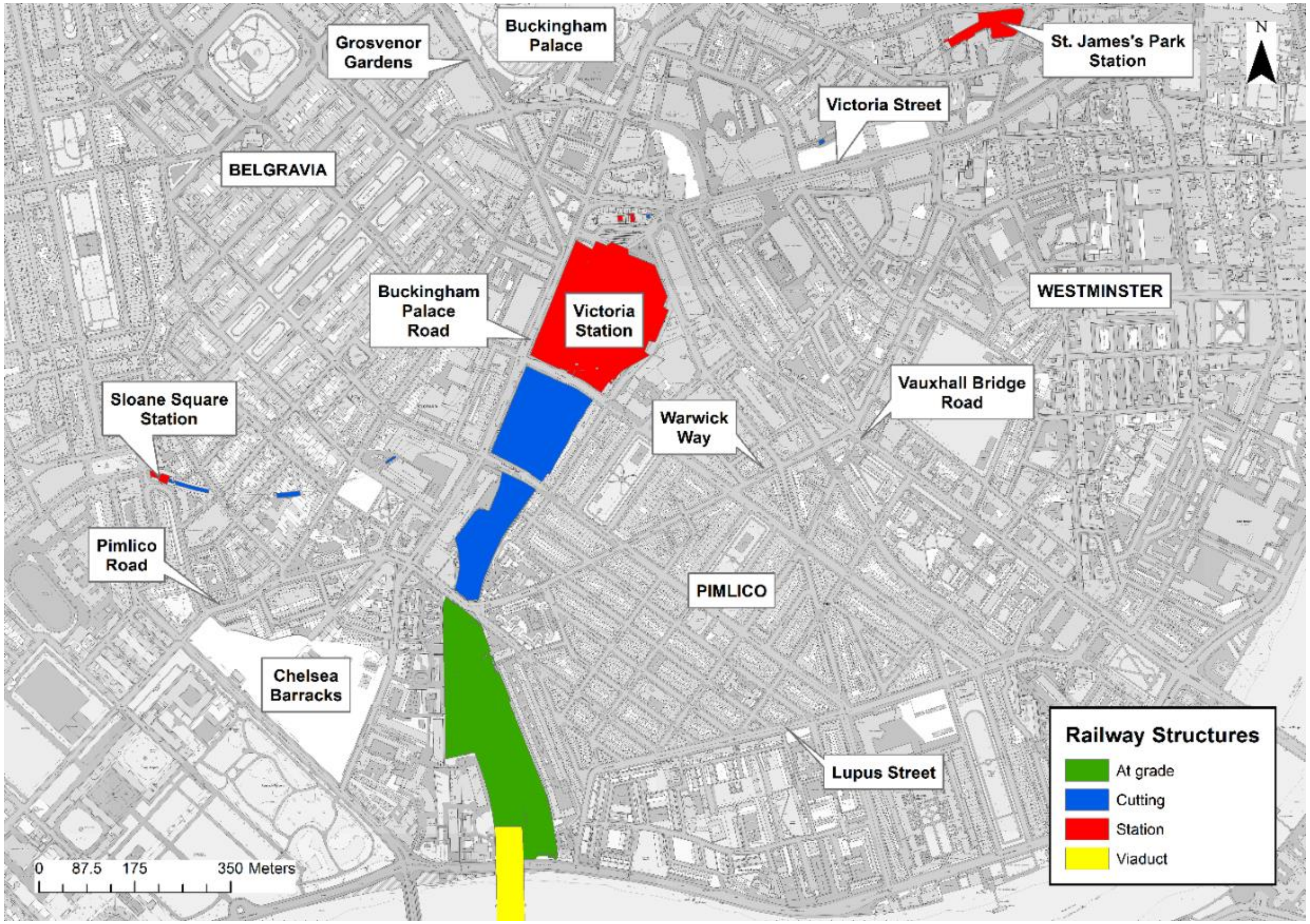

Figure 8.1: Victoria Station and infrastructure.

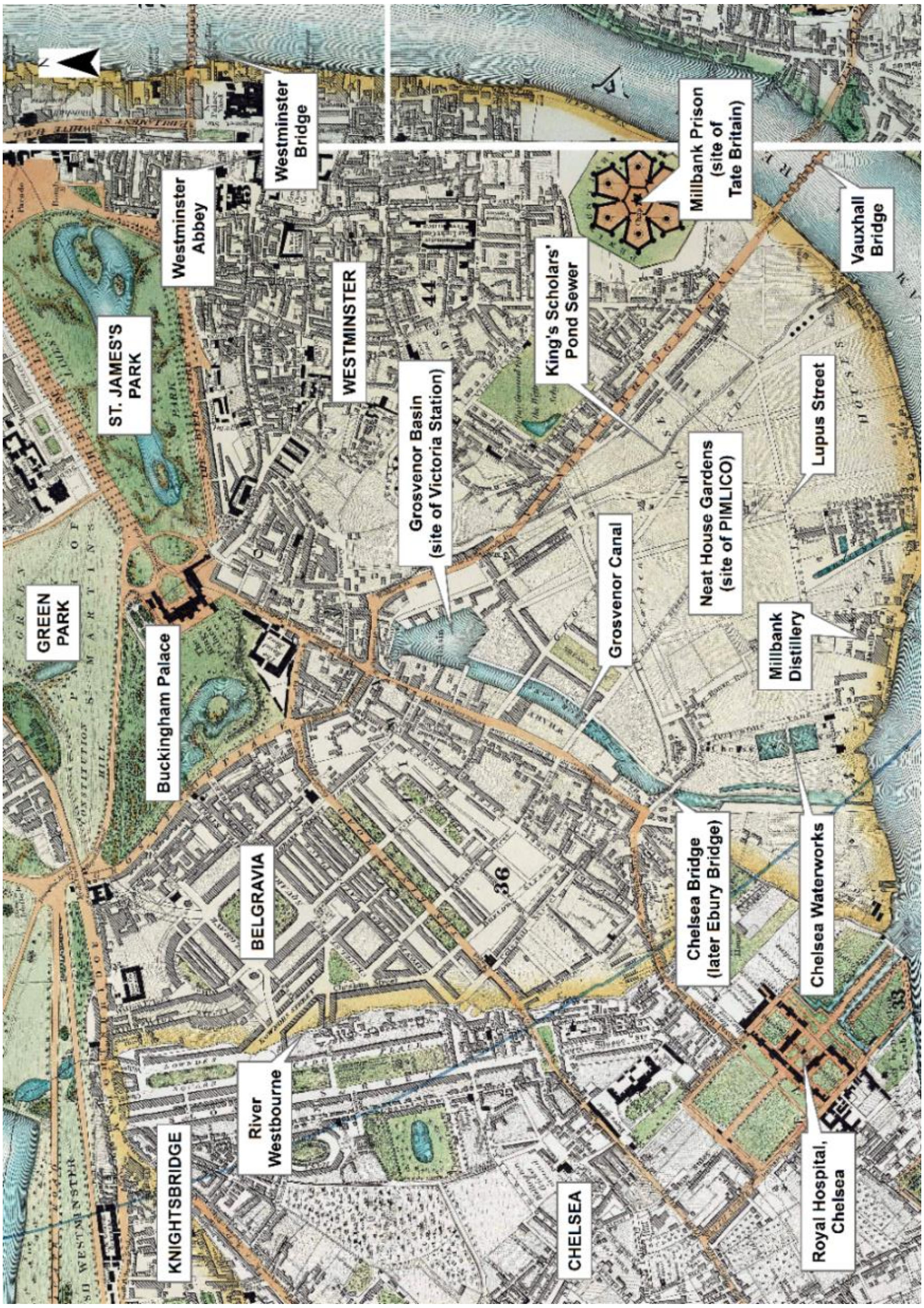

Figure 8.2: Victoria area, Greenwood Map 1827.[67]

[67] White lines across the map indicate missing information at the edges of adjoining sheets.

The station's development was complex. Until the construction of Victoria, services terminated at a junction south of the Thames in Battersea, optimistically labelled 'Pimlico'. In 1857 four rail companies joined together to build a 'Grosvenor Terminus' on the canal basin site, to bring services closer to the West End. The new station was completed in 1862 but by then one of the companies, the London, Brighton and South Coast Railway (LB&SCR) had left the partnership to run services on its own. This led to two separate stations being built, one for the LB&SCR and the other for the London Chatham and Dover Railway (LC&DR), and operated independently. Together they formed the new Victoria terminus, but were built in distinct architectural styles and for many years were separated by a wall.

Figure 8.3 shows the changes to railway structures at Victoria that have taken place since the 1880s. The popularity of both stations led to the widening of Grosvenor Bridge and the station approaches almost immediately, work completed in 1867. However, as shown in Figure 8.3 the major expansion came at the start of the twentieth century, and the footprint of the station and railway lines has remained virtually unchanged since. The LB&SCR rebuilt its side of Victoria between 1898 and 1908, with the new and enlarged building incorporating the Grosvenor Hotel. The station approaches were also expanded, built over the upper half of the Grosvenor Canal which was filled in north of Ebury Bridge. The eastern (London Chatham and Dover Railway) station was rebuilt in 1906. The two stations eventually became a single terminus when Southern Railway took over all services in 1923. Most of the remaining section of the Grosvenor canal closed in the 1920s, replaced by the LCC's Ebury Bridge Estate. A short stretch still exists, used to transport refuse to landfill until 1995, and retained as part of the Grosvenor Waterside development built in the early 2000s.

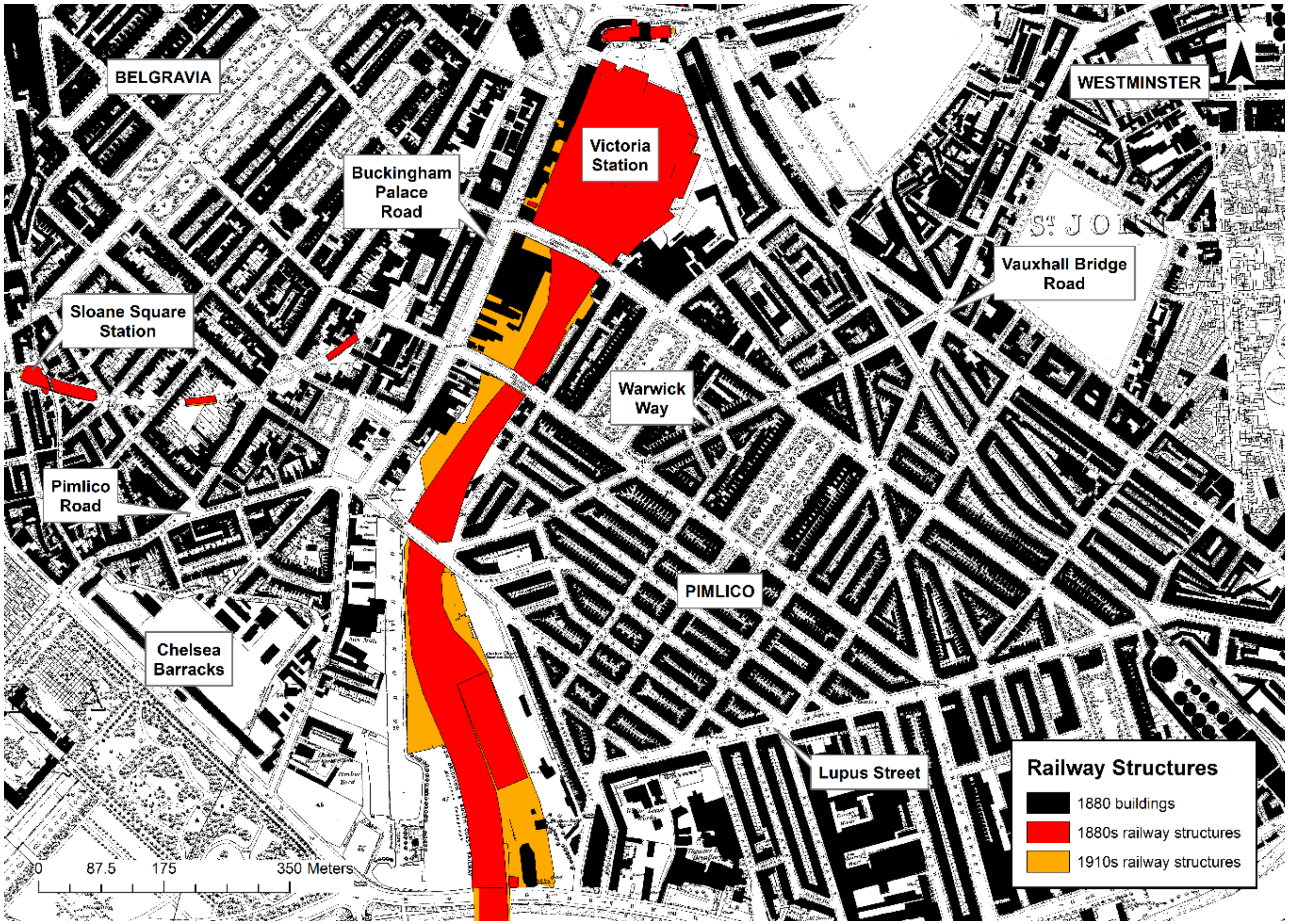

Figure 8.3: Victoria station expansion 1880s-2014.

Victoria neighbourhoods

The neighbourhoods around Victoria Station have been defined for analysis, covering most of Belgravia, Pimlico and Westminster, as shown in Figure 8.4.[68] The borders of Belgravia are, to the west, the boundary of the City of Westminster; to the north and north-west the Royal Parks and Buckingham Palace; and to the east by the approaches to Victoria Station. Pimlico is bounded to west by the railway; to the south and south-east by the River Thames; and to the north-east by Vauxhall Bridge Road. This separates Pimlico from Westminster, which is also bounded by the Thames to the east and St. James's Park to the north.

While Westminster was a village clustered around the Palace of Westminster and Westminster Abbey as early as the 1200s, Belgravia and Pimlico are much more recent developments. The once waterlogged land now occupied by the Victoria approaches formed a natural barrier between the areas on either side, to the north-west and south-east. The former was the Five Fields, open land beyond the edge of London owned by the Grosvenor family – "an undesirable and unwholesome piece of suburban waste" (Hobhouse, 1969 p. 1154). The Belgravia neighbourhood was built on the Five Fields, construction eventually beginning in 1821 after previous, abortive plans. Eaton Square, laid out on a diagonal which created the alignment for the whole development, dates from one of these earlier projects and was built in 1812. Builder Thomas Cubitt worked on Belgravia from 1824 until its completion in the 1840s. He built large, Italianate houses, and some even larger stand-alone mansions, set in a formal grid of wide streets and squares (Image 8.1).

Cubitt and the Grosvenor Estate succeeded from the start in building an expensive and exclusive residential area. Central Belgravia was served by mews streets, some with pubs tucked away in them. Otherwise, non-residential uses were conspicuous by their absence. A few pubs and shops were located at the very edges of the area, particularly beside the Grosvenor Canal wharves (and later the Victoria station) on Buckingham Palace Road. A more mixed area was built at the south-west corner of the neighbourhood, with smaller houses and workers' cottages on Bourne Street (beside the culverted River Westbourne, which made the area unsuitable for grander housing). Later, Belgravia became less exclusively residential as many larger houses were converted to embassy use, the area being convenient for the Court of St. James (which had relocated to Buckingham Palace in the 1820s).

[68] There is no definite neighbourhood known as 'Victoria'. Streets close to the station are referred to as in Victoria, particularly those around the western half of Victoria Street. However, all these streets are also part of either Belgravia, Pimlico or Westminster.

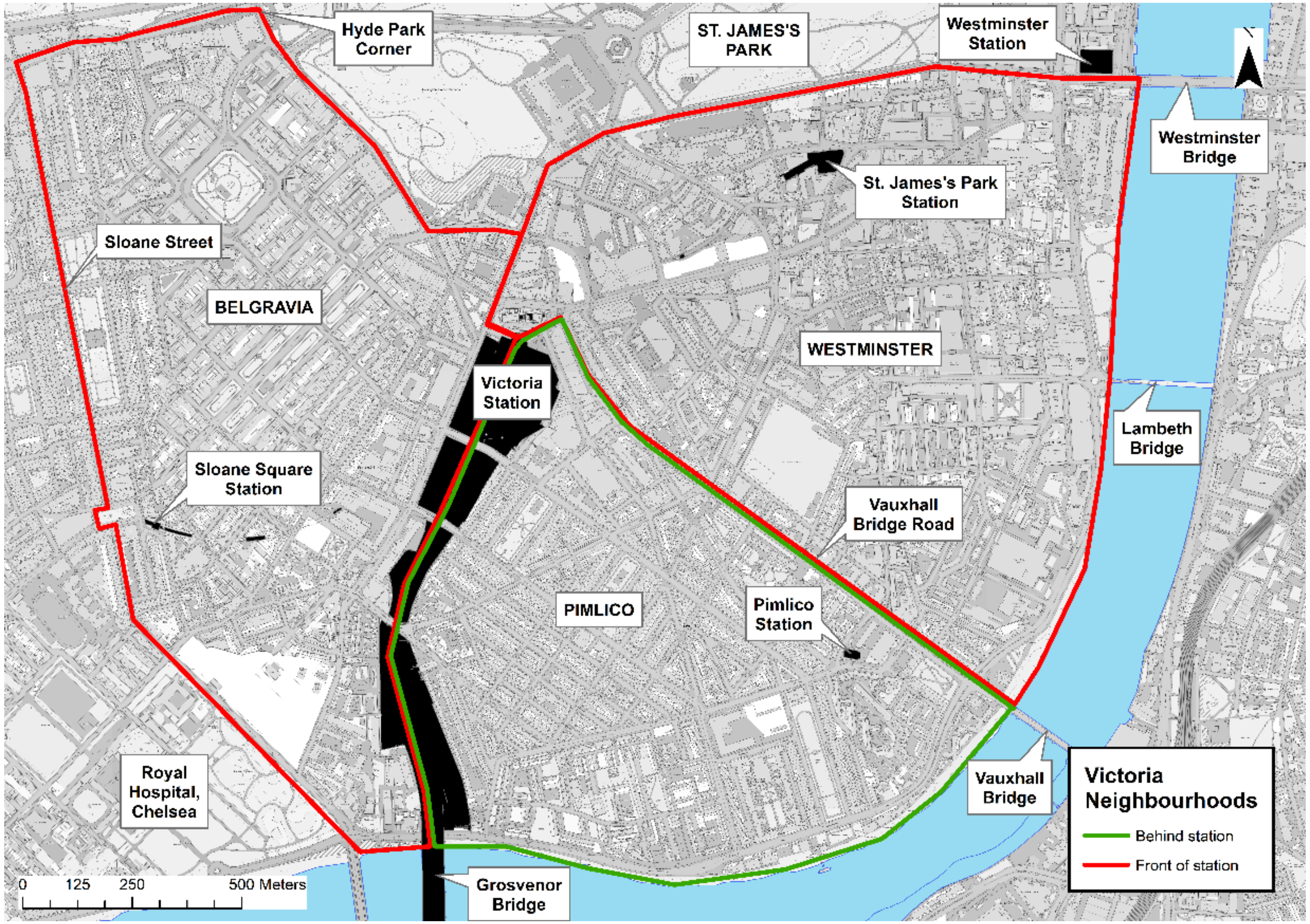

Figure 8.4: Victoria neighbourhood boundaries.

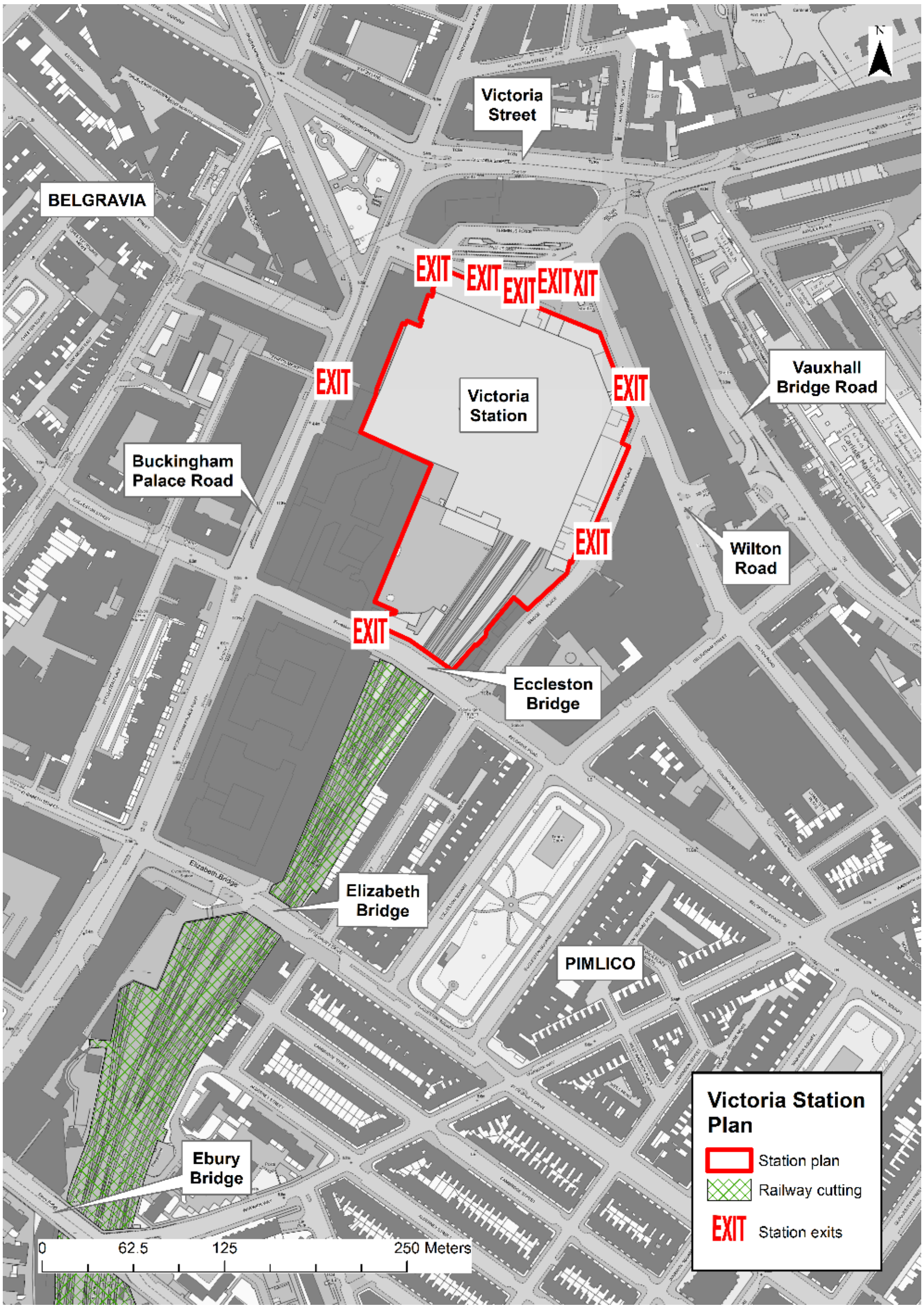

Figure 8.5: Victoria Station plan 2014.

Image 8.1: Chester Square, Belgravia.

While laying the groundwork for the development of Belgravia, Thomas Cubitt also entered into an agreement with the Grosvenor Estate over the Neat House Gardens, south-west of the Grosvenor Canal, which were occupied by market gardens growing produce for London. Jenny's Whim, a tea house and gardens next to the canal popular with, among others, Horace Walpole, was demolished when the railway was built (Walford, 1878, pp. 39-49). Cubitt began the process of laying out an entirely new neighbourhood, Pimlico, reclaiming the low-lying land with soil from the excavation of St. Katharine Docks at Tower Bridge.

The designs for Pimlico were different to those used in Belgravia, creating an area aimed less at the very rich. As in Belgravia, shops were located on roads at the edges of the new estate, but there were fewer mews streets and pubs were built into street corners rather than placed discreetly out of sight. This change in social tone is thought to have partly due to the longer development timescale (Pimlico took until 1875 to complete) which made a unified design ambition for the area harder to achieve, and partly because fashion had moved away from very large houses (Bradley and Pevsner, 2003). Before the railway was built to Victoria, Cubitt had successful fought off proposals from the Great Western Railway for a line through Pimlico (the company eventually chose Paddington instead). He was concerned that the railway would slice his land in two (Hobhouse, 1995).

The north-west/south-east alignment of the Belgravia grid was also used to determine the orientation of Pimlico. Its main routes were continuations of Belgravia streets, which bridged the canal and the railway in three places, at Eccleston Bridge, Elizabeth Bridge and Ebury Bridge. The only routes in Pimlico that did not follow a grid plan were those that pre-dated Cubitt, including Tachbrook Street built over the route of the King's Scholars' Pond Sewer (culverted River Tyburn) and the east/west Lupus Street, which separated the new houses from the pre-existing riverside strip of wharves and factories.

Block size analysis in Figures 8.4 and 8.5 shows the urban grain in Belgravia, Pimlico and Westminster in the 1880s and today. The basic grid structure laid out by Thomas Cubitt still forms the core of Belgravia and Pimlico, and the Regency and Victorian buildings are substantially unaltered. The street layout and block sizes contrast with the finer grain of Westminster closest to the river, of medieval origin. Western Westminster, connecting the old centre with Victoria Station, is much later and consists of larger blocks. Belgravia is still London's most expensive neighbourhood, with a dual identity as a district of large town houses and as the favoured location for international embassies. Redevelopment has taken place at the very edges of the neighbourhood closest to the station, along Buckingham Palace Road where the wharves of Grosvenor Canal were once located, and around the Grosvenor Gardens junction at the station's north-west corner.

Pimlico retains both the grid pattern at its centre and the majority of its original nineteenth century stuccoed terraces. It is residential and much quieter than streets in front of the station, with no sense of central London bustle. Like Belgravia, change has occurred around the edges of the grid, particularly closest to the station and to the Thames. However, this redevelopment has taken place on a greater scale than in Belgravia and the reputation of the neighbourhood is different too – a less socially desirable location with large social housing developments. It also has an historical reputation as a centre for prostitution, influenced by proximity to the railway. According to Stout (1997) "Pimlico soon became a sort of annexe to the station, its larger houses transformed into hotels, boarding-houses and other, seedier, establishments catering for the varied needs of the capital" (Stout, 1997, p. 57).

The station corridor separating Belgravia and Pimlico has seen almost complete physical change, with industrial buildings and smaller nineteenth plots replaced by larger, purpose-built office blocks now occupy the majority of sites on both sides of Buckingham Palace Road along the station flank.

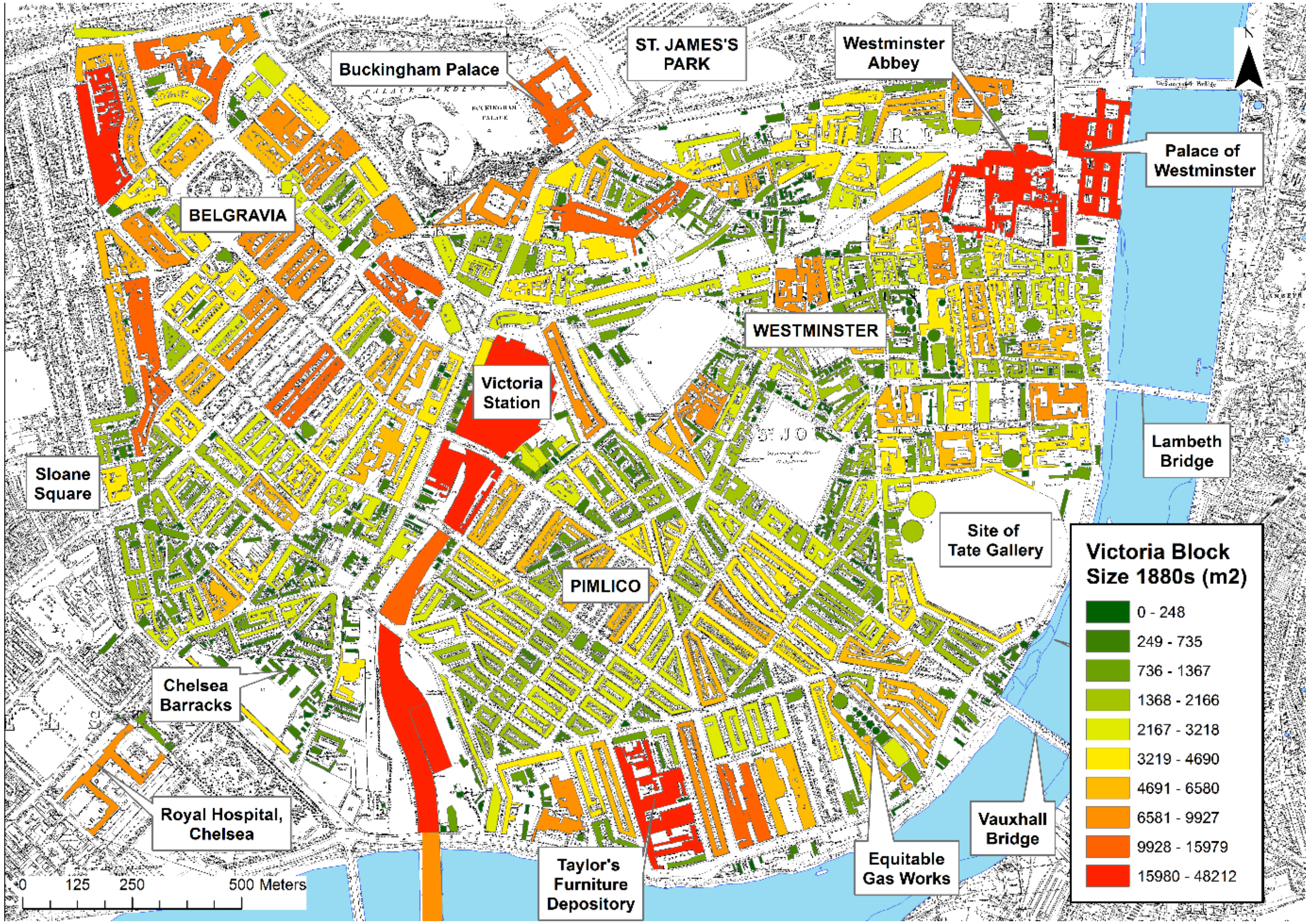

Figure 8.6: Victoria block sizes, 1880s.

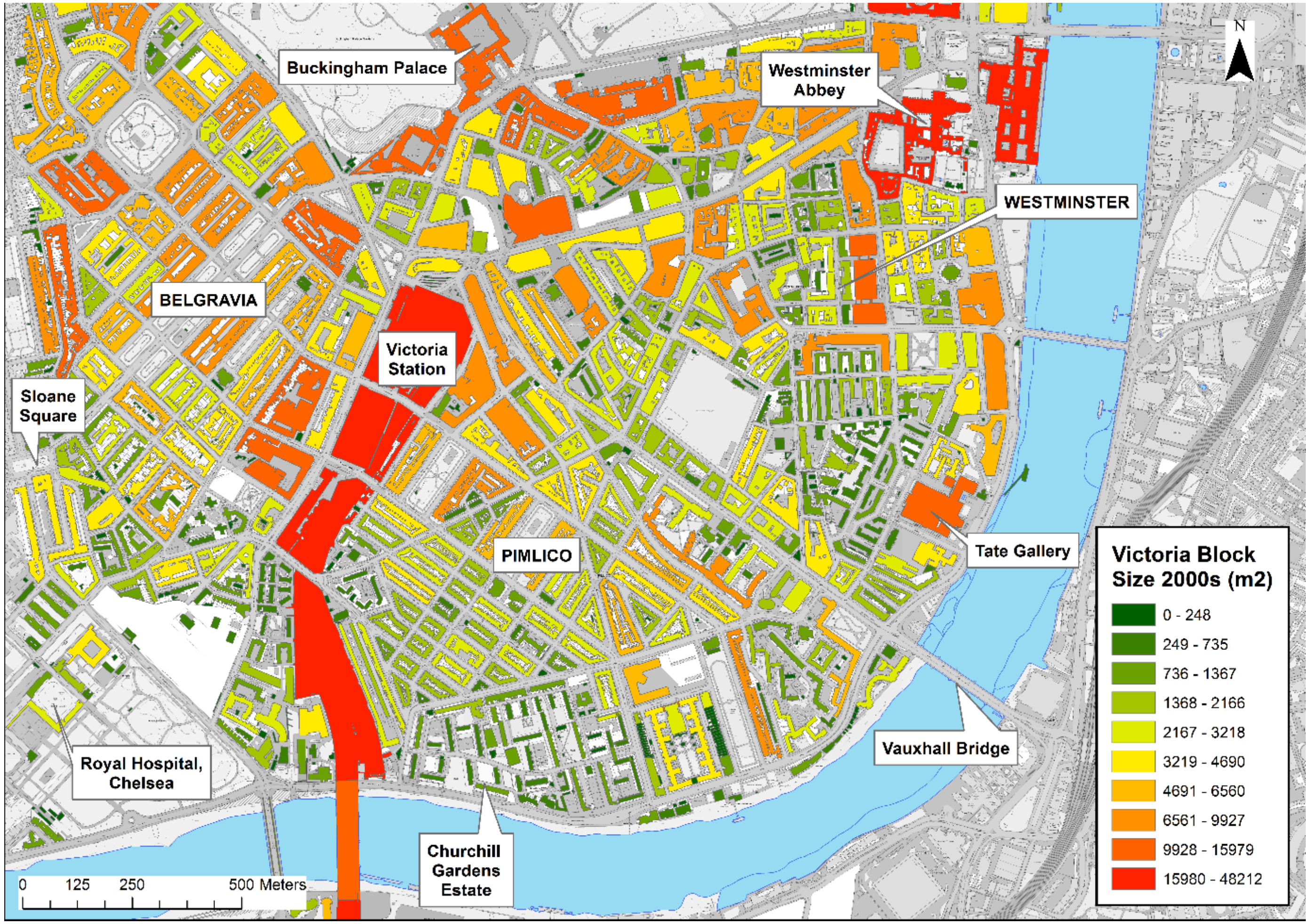

Figure 8.7: Victoria block sizes, 2014.

A similar process has taken place immediately in front of the station and along Victoria Street. This is now the high street for Westminster, redeveloped in the 1960s as a location for Government offices second only to Whitehall. The street was first constructed in the 1860s, partly to provide improved access to Belgravia and Pimlico, and partly to facilitate the clearance of the Palmer's Village and 'Devil's Acre' slums near Westminster Abbey. The Victorian blocks have been almost entirely replaced, and a development in progress at the time of writing, Land Securities' Nova SW1 at No.123 Victoria Street, is on the site of one of the last blocks retaining Victorian and Edwardian buildings and associated smaller plot sizes. Redevelopment has concentrated in front of the station and on its Belgravia side.

Block size maps also show the almost complete twentieth century redevelopment of Pimlico between Lupus Street and the Thames. This section of riverside was mainly industrial during the nineteenth century, with docks and wharves, and large complexes including the Thames Bank Distillery, Taylor's Furniture Depository, the Army and Navy Co-Operative Society Factory, the Royal Army Clothing Depot and the Equitable Gas Works. Streets of terraced housing were squeezed between these factory sites. From the 1930s the industry was replaced with a succession of residential estates on sites beside the railway and river.

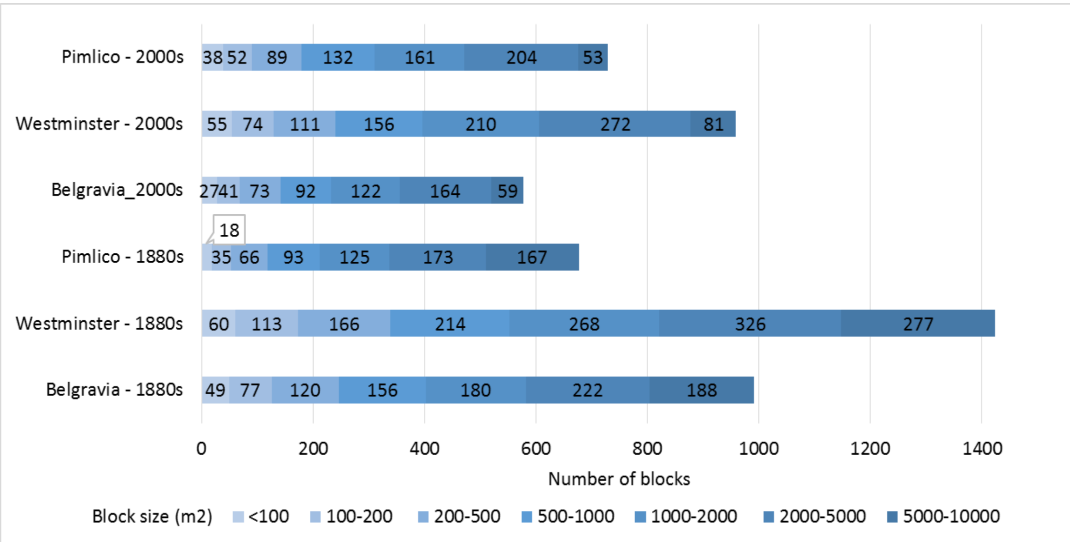

Figure 8.8: Frequency distribution of blocks by size, Victoria 1880s and 2010s.

Figure 8.8 shows a frequency distribution analysis of block sizes in the 1880s and in the 2010s, calculated from the maps above. Belgravia, Pimlico and Westminster are analysed separately to allow comparison. The boundaries used for these areas are illustrated below (Figure 8.9), and the rationale for their selection explained. The station buildings and railway lines are excluded from these figures, as they form the separation between Belgravia and Pimlico and therefore belong exclusively to neither neighbourhood.

The frequency distribution demonstrates that the total number of blocks has fallen in Belgravia and in Westminster since the 1880s, but has increased in Pimlico. In Belgravia, the total fell from 288 to 192 (33 per cent fewer) despite new development near the railway, while Westminster has seen a fall from 361 to 303 (16 per cent fewer). In both areas, this changes seems to reflect a move from characteristic Victorian blocks, penetrated by alleyways and with uses in block interiors, to remodelled twenty-first century versions in which alleys have frequently been closed and the interiors of the blocks are now single use and inaccessible. In Pimlico, the block total has increased from 205 to 219 (42 per cent more), suggesting a different process of change compared with surrounding areas. The fragmentation of blocks near the railway and the rivers through the construction of housing estates is the clearest reason for this difference.

The distribution shows different size profiles between the two areas in both during both periods. Blocks in Westminster are the largest, with more blocks between 2000m^2 and 5000m^2 than in the other two neighbourhoods. This reflects the construction of larger blocks in the northern part of Westminster, along Victoria Street and near the Thames, built for a combination of government offices and large department stores.

In Belgravia the size profile has shifted, with fewer large blocks and more small blocks. The increase in small blocks is partly due to the construction of the 1930s Ebury Estate, built between Chelsea Barracks and the railway lines, a much denser development that the wharves that previously occupied part of the site. Pimlico has seen an increase in the number of the smallest blocks (less than 100m^2) and of middle size blocks (between 500m^2 and 1000m^2) a size combination typically found on the riverside Churchill Gardens Estate.

These changes reflect a contrast in morphology between Belgravia, Westminster and Pimlico. Significant change has taken place in Westminster and in Pimlico since the 1880s, but change of very different kinds. Westminster has become a city centre, with large blocks hosting major commercial, retail and government activities. Pimlico is a planned, nineteenth century grid surrounded by a fragmented townscape dominated by stand-alone housing blocks at its edges, beside the river and the railway. Belgravia is a residential district, but one with particularly large houses and therefore also suitable as an embassy district. Consolidation into larger blocks has taken place in places at the front of Victoria Station, the north-western corner of Belgravia and in Westminster. Change and fragmentation of blocks is found almost exclusively in areas closest to the tracks behind Victoria Station, and in what appear to be the most isolated parts of the station neighbourhoods, those least accessible from the station.

Spatial analysis

Network change

Overlaying the street networks for the 1880s and 2010s in Figure 8.9 shows that the street pattern has remained relatively stable between the two periods with the exception of specific areas. Substantial post-war changes to the network have taken place mostly either close to the station, or beside the Thames.

Different patterns of network change are apparent across the three neighbourhoods between the two time periods, in Table 8.1. Segment numbers increased by 9.5 per cent in Westminster, by nearly 18 per cent in Belgravia and by 51.6 per cent in Pimlico. In Westminster mean segment length increased by 10.9 per cent and in Belgravia by 7.1 per cent, but in Pimlico it fell by 5 per cent.

Image 8.2: Peabody Avenue Estate, railway behind fence on right of picture.

In Pimlico this major change in segment numbers, accompanied by a reduction in segment length reflects the scale and nature of housing development since the 1880s. This has been particularly focused in the area between Lupus Street and the Thames, where large-scale housing redevelopment began with Dolphin Square and the Tachbrook Estate, both built in the 1930s. Dolphin Square is a perimeter block, entirely inaccessible to non-residents, but the Tachbrook Estate was the first in a series of modernist developments, featuring stand-alone medium-rise blocks set back from surrounding streets, with vehicles separated from pedestrians. After the Second World War, developments with similar characteristics but built on a larger scale came to comprise nearly all of Pimlico south of Lupus Street. The Churchill Gardens Estate was built 1947-62; Abbots Manor Estate was built between the 1950s and the 1970s; and Bessborough Gardens completed in the 1980s. The Lillington Gardens Estate, a little further north on Vauxhall Bridge Road, was constructed between 1964 and 1972. The overall result was that more complex street plans with more, shorter segments replaced through routes.

An earlier Pimlico development was directly shaped by the proximity of the railway. The nineteenth century Peabody Avenue Estate was built in 1876 on an awkwardly-shaped site, long and narrow, to the east of the Victoria sidings, an unwanted strip of land bought from the London Chatham and Dover Railway. As a result, its blocks are 200m long and only a few metres wide (Image 8.2).

In Belgravia, almost the only changes to the street network are found between the railway and Buckingham Palace Road, where infill developments on formerly industrial land include the Ebury Bridge Estate and Grosvenor Waterside. These street layouts are entirely cut-off on their eastern side by the railway. The former Chelsea Barracks site, opposite, is also under development at the time of writing.

The street layout of Westminster has remained the most stable of the three neighbourhoods. The major additions shown on Figure 8.9 took place during the late 1880s and 1890s, with the building of Millbank Estate and the Tate Gallery on the site of Millbank Prison, and Westminster Cathedral and surrounding streets on the site of Tothill Fields Prison. The late nineteenth century Peabody Estates at Abbey Orchard and Old Pye Street, and the dense series of parallel paths through the proto-modernist 1920s Page Street (Grosvenor) Estate, account for the majority of other changes. The street layout of Westminster was settled before The Second World War, while in the post-war era the structure of Belgravia has changed only along the Victoria railway corridor. Pimlico, on the other hand, has been substantially reconstructed around its edges, but its core Cubitt grid has been left largely untouched.

	Total number of segments	Mean segment length (m)	Dead ends as a percentage of total segments
Belgravia 1880s	538	56	0.7%
Belgravia 2014	634	60	2.7%
Percentage change	**18%**	**7%**	**-17%**
Pimlico 1880s	399	60	1.5%
Pimlico 2014	605	57	1.2%
Percentage change	**52%**	**-5%**	**0.3%**
Westminster 1880s	602	46	1.5%
Westminster 2014	659	51	3.9%
Percentage change	**9%**	**11%**	**N/A**

Table 8.1: Street network data for Victoria, 1880s and 2014.[69]

[69] Lower value of the two time periods shown in red, for ease of comparison.

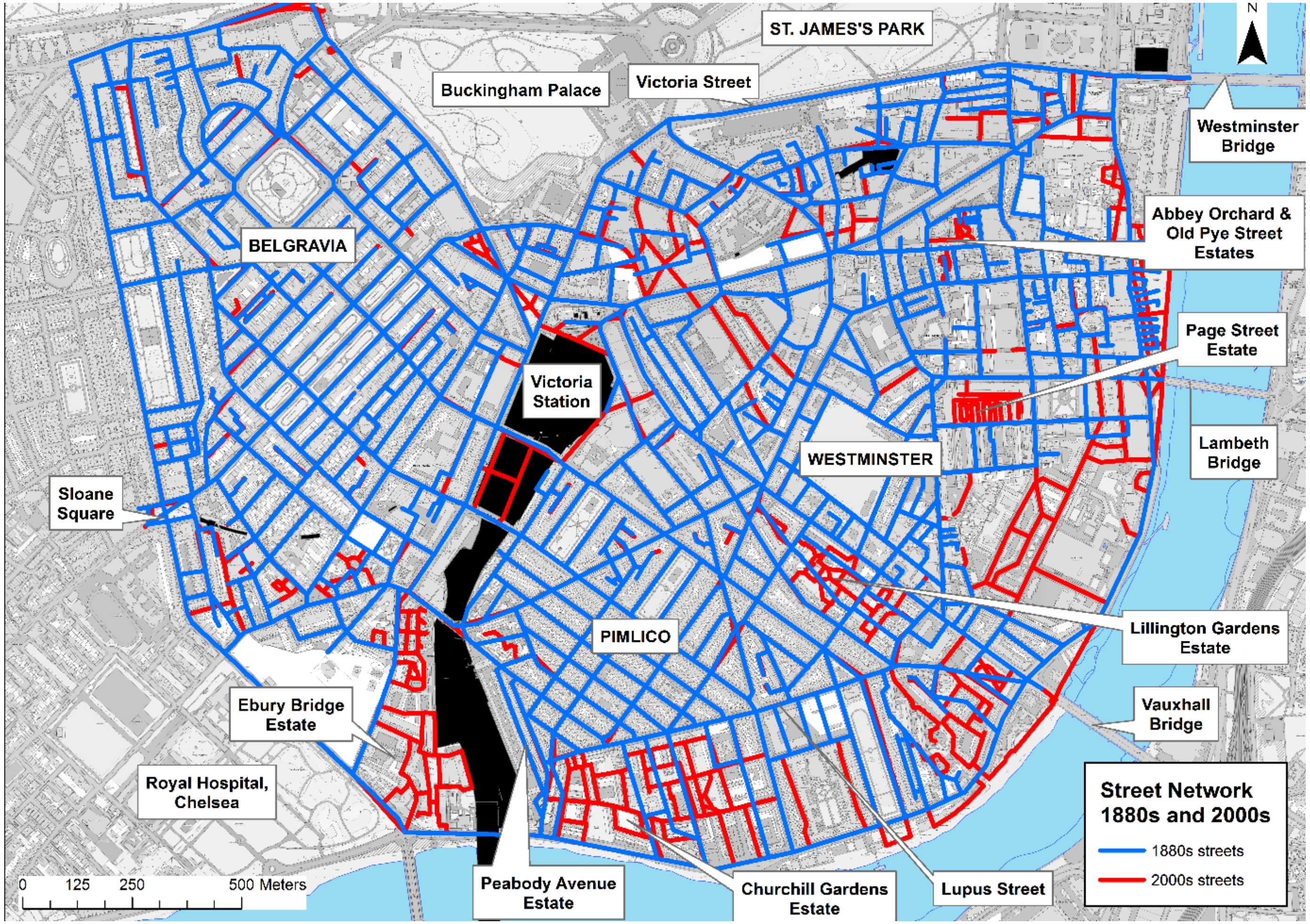

Figure 8.9: Victoria streets 1880s and 2014.

Space syntax analysis

Comparison between Choice at 3000m in the two time periods, in Figures 8.10 and 8.11, identifies two main routes that traverse the Victoria area in the shape of an 'x', crossing immediately in front of the station where Grosvenor Gardens/Victoria Street (east/west) meets Buckingham Palace Road (north/south). The east-west axis is the major commercial and retail artery for Westminster and Victoria, the route on to which Victoria Station faces. The north/south axis forms the western side of the station and runs along the railway lines to the Thames behind Victoria, between Belgravia and Pimlico.

Choice measured at 3000m highlights a network of through routes across the area, forming an orthogonal grid aligned north-east/south-west. The Buckingham Palace Road axis runs along the western side of the station all the way across the neighbourhood, directly linked to the Belgravia cross-streets. The Pimlico side of the station has no equivalent through route alongside the station and railway, being blocked by the curve of the railway lines at Ebury Bridge.

The major through route east of Victoria, Vauxhall Bridge Road, runs east-west, defining the northern boundary of Pimlico. Between the river and Victoria, a distance of 1.25km, three bridges cross the station throat and a fourth route passes under the lines along the Thames embankment. High Choice routes in the Pimlico grid connect to these crossing points. However, they do not link across the whole neighbourhood, ending at Lupus Street where the Churchill Gardens Estate blocks direct routes to the Thames.

The Belgravia and Pimlico grids both end abruptly at the Victoria railway lines, which create a wide area of separation between the neighbourhoods. However, the Belgravia grid is connected to the west, along its longest edge, with the adjoining Knightsbridge and Chelsea grids. Pimlico is bounded not only by the railway to the west, but also by the Thames and riverside housing estates to the south and east, additionally preventing through movement.

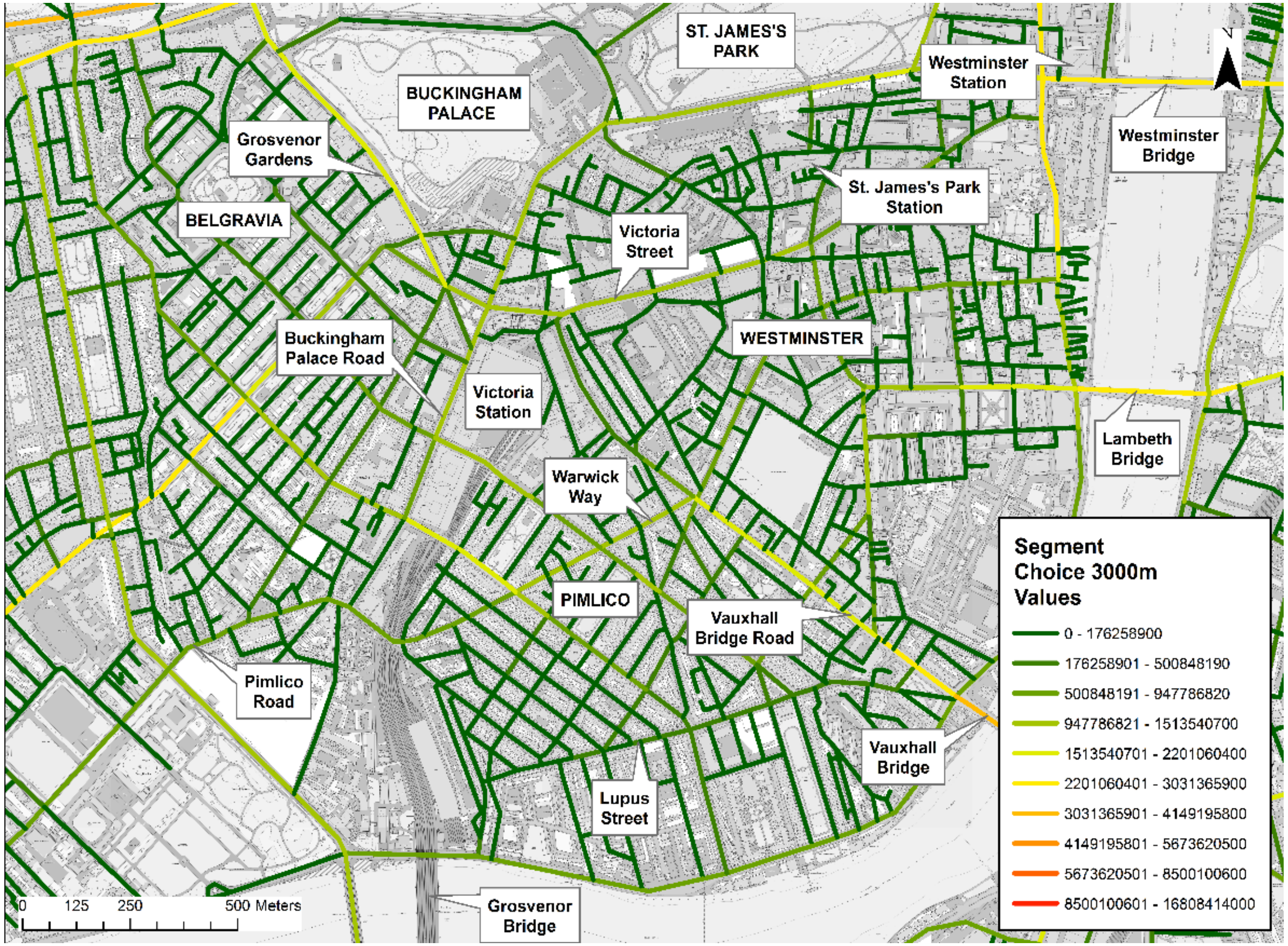

Figure 8.10: Choice 3000m, Victoria 1880s.

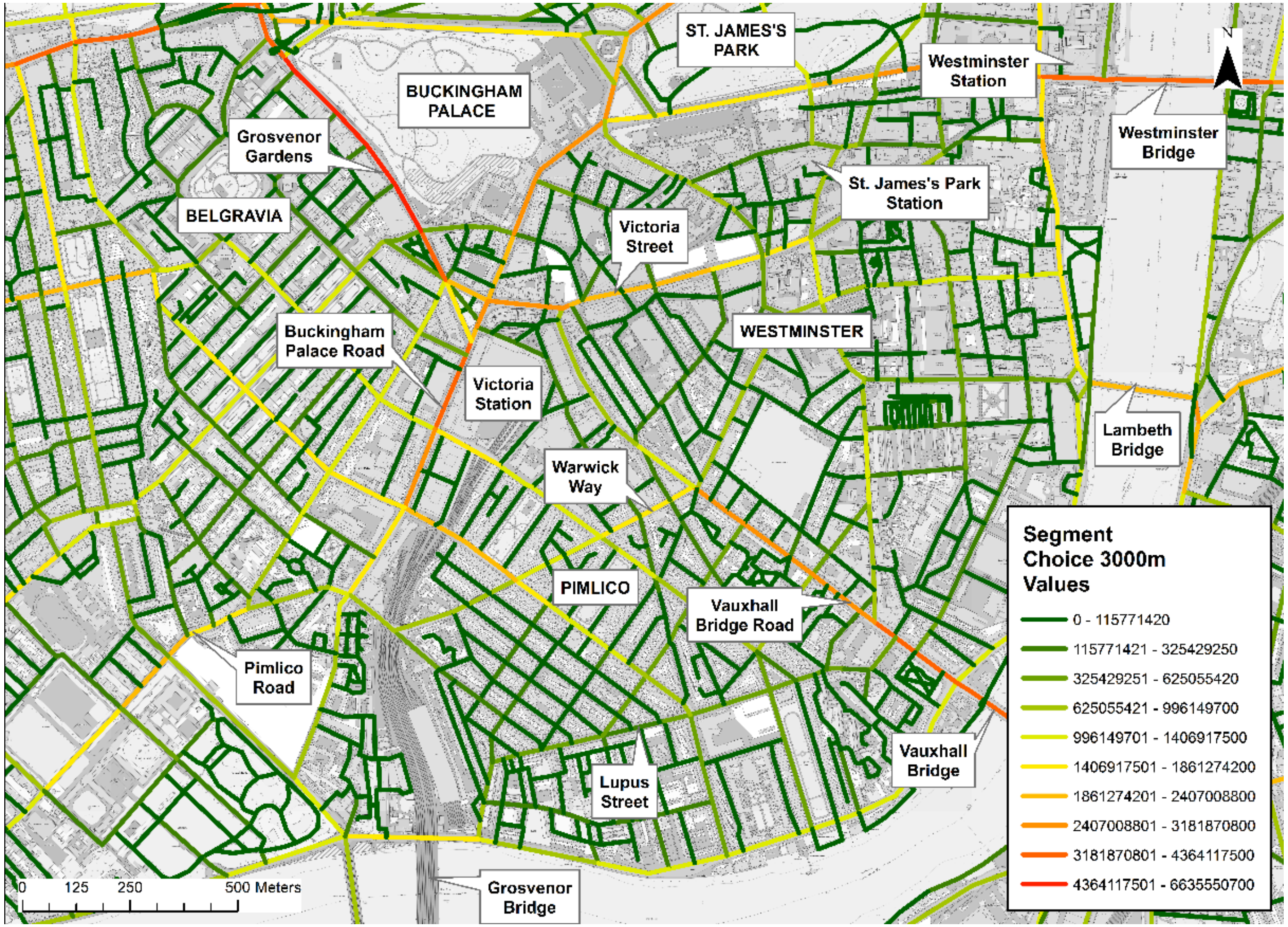

Figure 8.11: Choice 3000m, Victoria 2014.

	Choice 3000m	Choice 800m	Choice 400m
Belgravia 1880s	353575781	10235608	2447805
Belgravia 2010s	313669774	8319236	2175988
Percentage change	**-11%**	**-19%**	**-11%**
Pimlico 1880s	317037591	10797705	2683395
Pimlico 2010s	228348118	7636759	2048879
Percentage change	**-28%**	**-29%**	**-24%**
Westminster 1880s	376534825	7511311	2328466
Westminster 2010s	472629786	9324767	2740091
Percentage change	**26%**	**24%**	**18%**

Table 8.2: Mean Choice values for Victoria, 1880s and 2014.[70]

For both Pimlico and Belgravia mean Choice has decreased between the two time periods at both 3000m (inter-neighbourhood scale) and at 800m (intra-neighbourhood scale). In Pimlico, the decrease has been by a greater percentage at both scales than in Belgravia. On the other hand, Choice has increased at both scales in Westminster indicating greater connectivity for journeys across the area.

In the 1880s Choice values for Pimlico were lower than for Belgravia at 3000m, and higher at 800m and 400m; now both they are lower at all three scales for Pimlico. This change suggests that the neighbourhood has, relatively, become more spatially isolated.

At 800m, the decrease in both neighbourhoods is likely to be a consequence of the more poorly connected, self-contained street layouts such as those found in the various estates discussed above. The increase in Choice values in Westminster is likely to reflect the connection of the large, empty sites left in the 1880s by the demolitions of Tothill Fields and Millbank Prisons.

[70] Lower value of the two time periods shown in red, for ease of comparison.

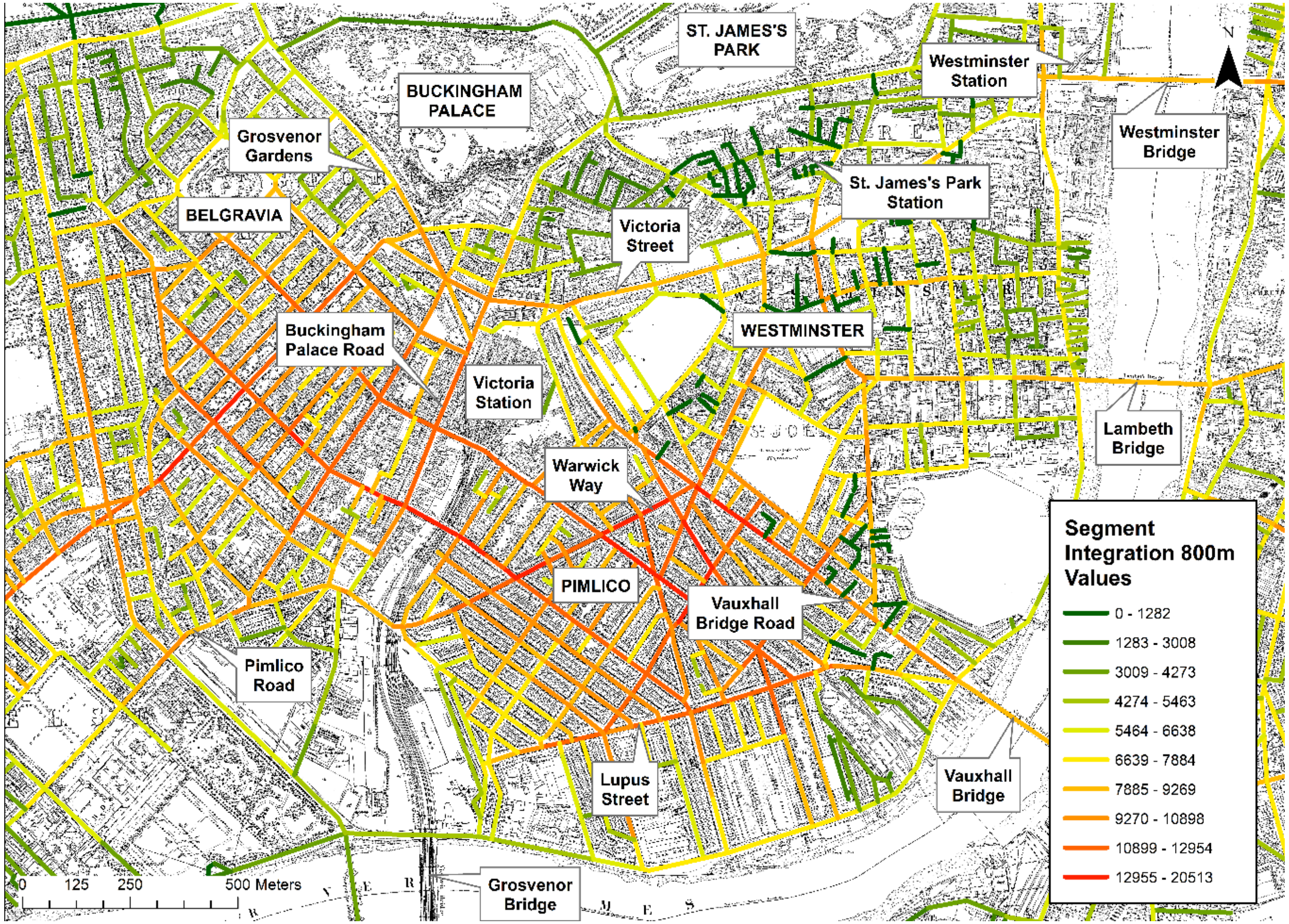

Figure 8.12: Integration 800m, Victoria 1880s.

Figure 8.13: Integration 800m, Victoria 2014.

Integration measured at scales of 800m identifies local centres in London, both in the 1880s and the 2010s. Maps for the whole of Inner London show the City, West End, Westminster and the South Bank as separate, distinct clusters of high value local Integration. Apart from the West End, however, the highest value cluster of streets is around Victoria Station. Integration values here are higher than in any other part of Inner London beyond the core.

Figures 8.12 and 8.13 show Integration at 800m (intra-neighbourhood scale), for the Victoria neighbourhoods. The highest Integration values are found on the streets bordering Victoria Station, and in the Belgravia and Pimlico grids. Integration values fall with distance behind the station, and this is particularly noticeable in the 2014 street network. Those parts of the grids closest to the station are the most integrated, while Integration south of Lupus Street and between the railway and Chelsea Barracks is low.

Table 8.3 shows mean figures for Integration at 3000m and at 800m. In Westminster, Integration values have risen at both scales, which again is likely to be partly a result of new street connections across the two prison sites, around Westminster Cathedral and the Tate Gallery. In both Belgravia and Pimlico, Integration values have fallen between the two periods.

	Integration 3000m	Integration 800m	Integration 400m
Belgravia 1880s	353575781	10235608	3502
Belgravia 2010s	313669774	8319236	3232
Percentage change	**-24%**	**-21%**	**-8%**
Pimlico 1880s	317037591	10797705	3877
Pimlico 2010s	228348118	7636759	3220
Percentage change	**-33%**	**-39%**	**-17%**
Westminster 1880s	195602	5790	4143
Westminster 2010s	239462	6690	5286
Percentage change	**22%**	**16%**	**28%**

Table 8.3: Mean Integration values Victoria, 1880s and 2010s.[71]

[71] Lower value of the two time periods shown in red, for ease of comparison.

Values have fallen further in Pimlico than Belgravia, and are also lower for Pimlico at both scales, although they were higher at 800m in the 1880s. These changes suggest it is less likely that journeys will be made from Pimlico to destinations in adjacent neighbourhoods, or that journeys will be made to destinations across Pimlico itself. These changes fit with the apparent increased segregation of the neighbourhood, and the changes to accessibility around the edges of the street grid.

Spatial analysis reveals two distinct, planned neighbourhoods based around grids, but separated from each other by the Victoria approaches, with limited crossing points. The large blocks containing the station, its throat and the buildings alongside and over the railway tracks cut the area in two. Of the two neighbourhoods, Pimlico is less accessible and connected than Belgravia, bounded not only by the railway but also by the Thames, and separated from the station and the river by non-grid street networks. All three neighbourhoods, including Westminster form part of a local centre which, rather than being integral to either neighbourhood, is centred on Victoria Station and the main roads closest to it, to the north and west.

Land use analysis

Land use analysis of the Victoria neighbourhood indicates the nature of change between the 1880s and the 2010s. Figures 8.14 and 8.15 show distribution of accommodation. As hotels and guest houses are very likely to be used by travellers, their location may shed particular light on the spatial relationship between the station and its surroundings.

In the 1880s accommodation was found in a limited number of locations around Victoria. Hotels and guest houses were located in the block containing the station itself. They are also found in Belgravia, in streets close to the station, immediately to the west on Buckingham Palace Road and were particularly concentrated a block further away, on Ebury Street. There was a third cluster slightly further west, on Eaton Terrace. Hotels were located in Pimlico too, but spread across a much wider area, between Warwick Way and Lupus Street, at some distance from the station itself. This pattern is likely to be related to the high level of prostitution in the area at the time (see below). By the 2010s, this pattern had changed. There are now fewer hotels overall. In Belgravia, they are more widely spread, and are also found in Westminster, near Victoria Street. The majority of accommodation in the area is now found in Pimlico. It is much more clustered, and restricted to the northern half of the area. In southern Pimlico it has almost entirely disappeared as a land use.

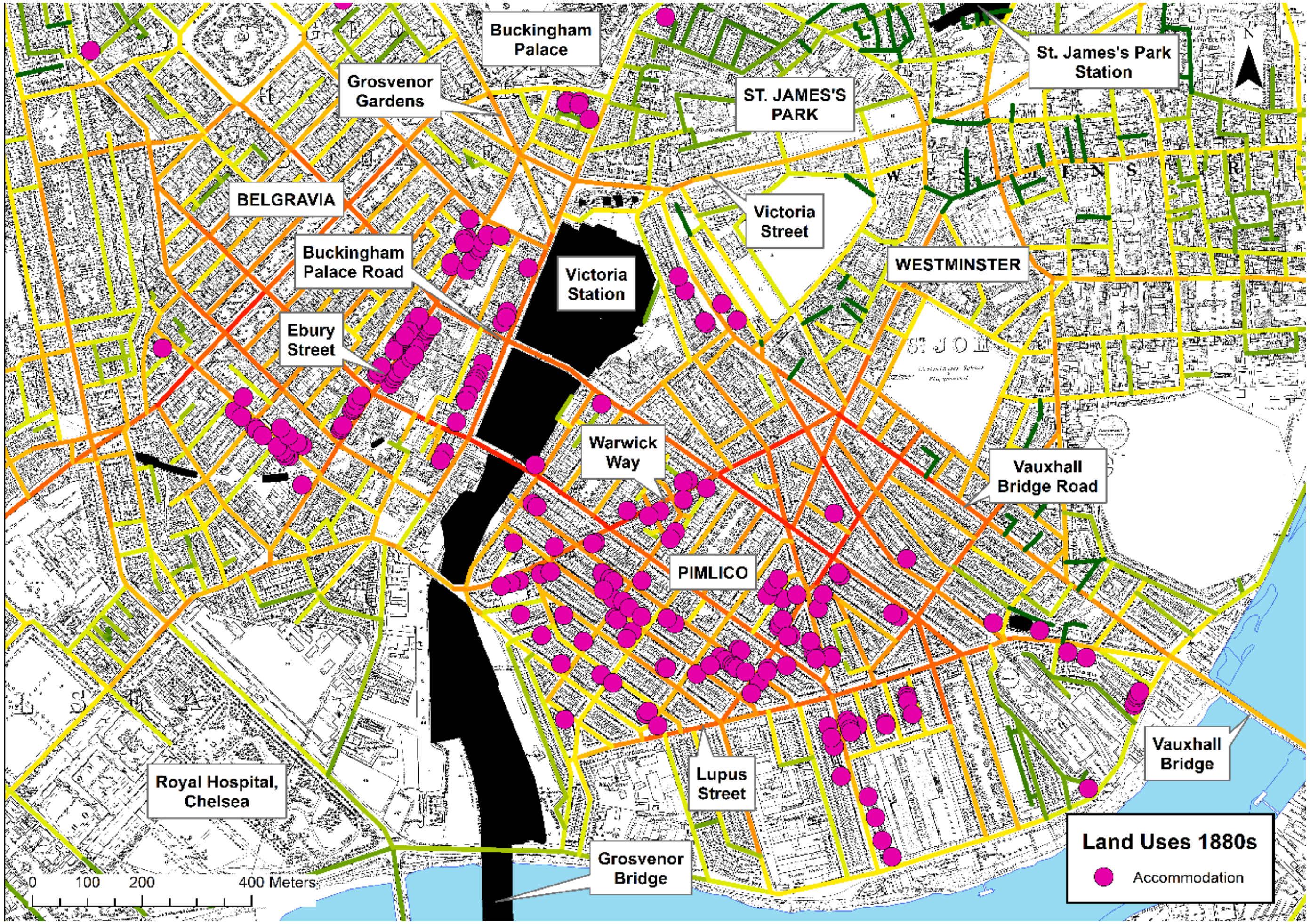

Figure 8.14: Victoria accommodation 1880s.

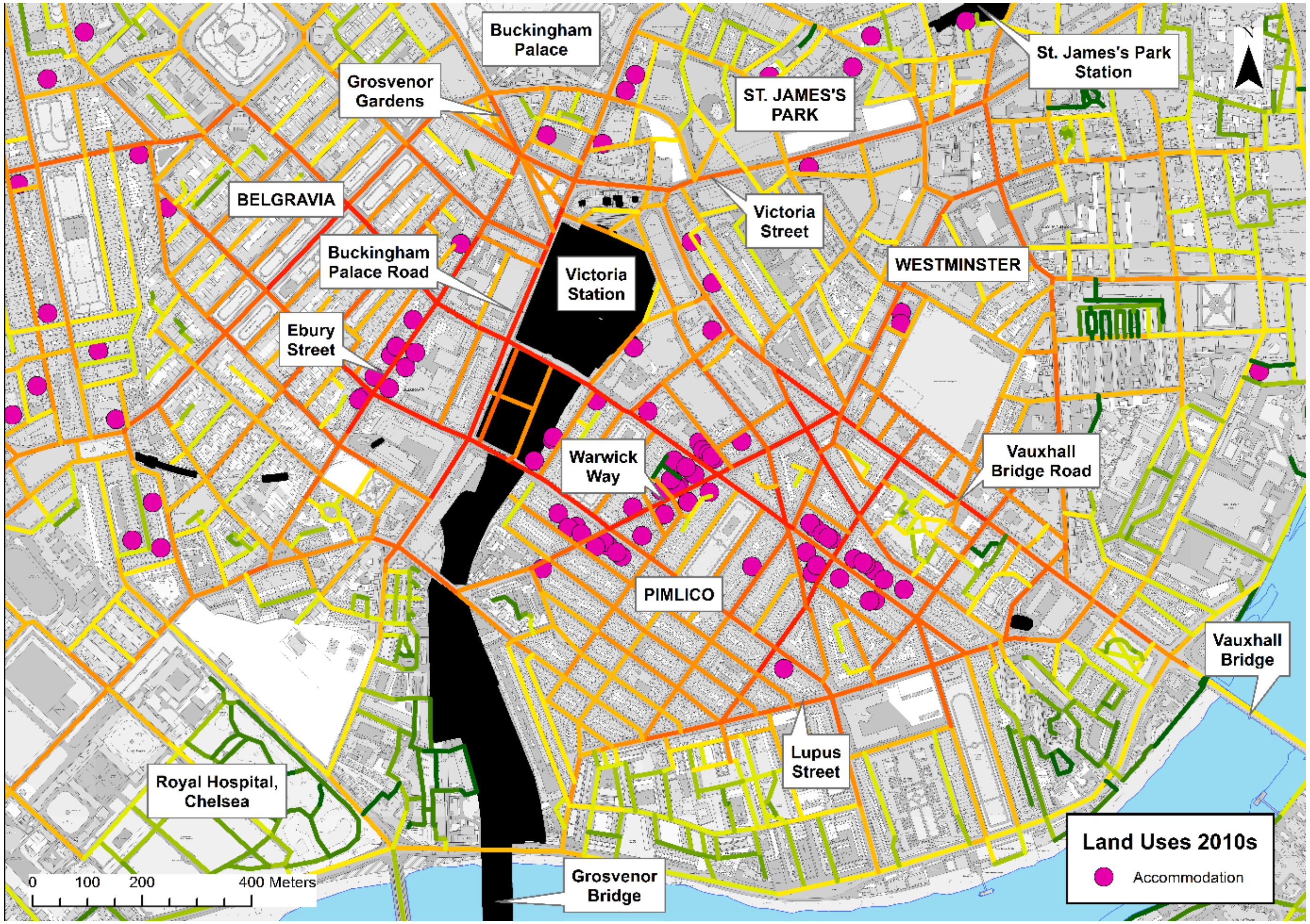

Figure 8.15: Victoria accommodation 2014.

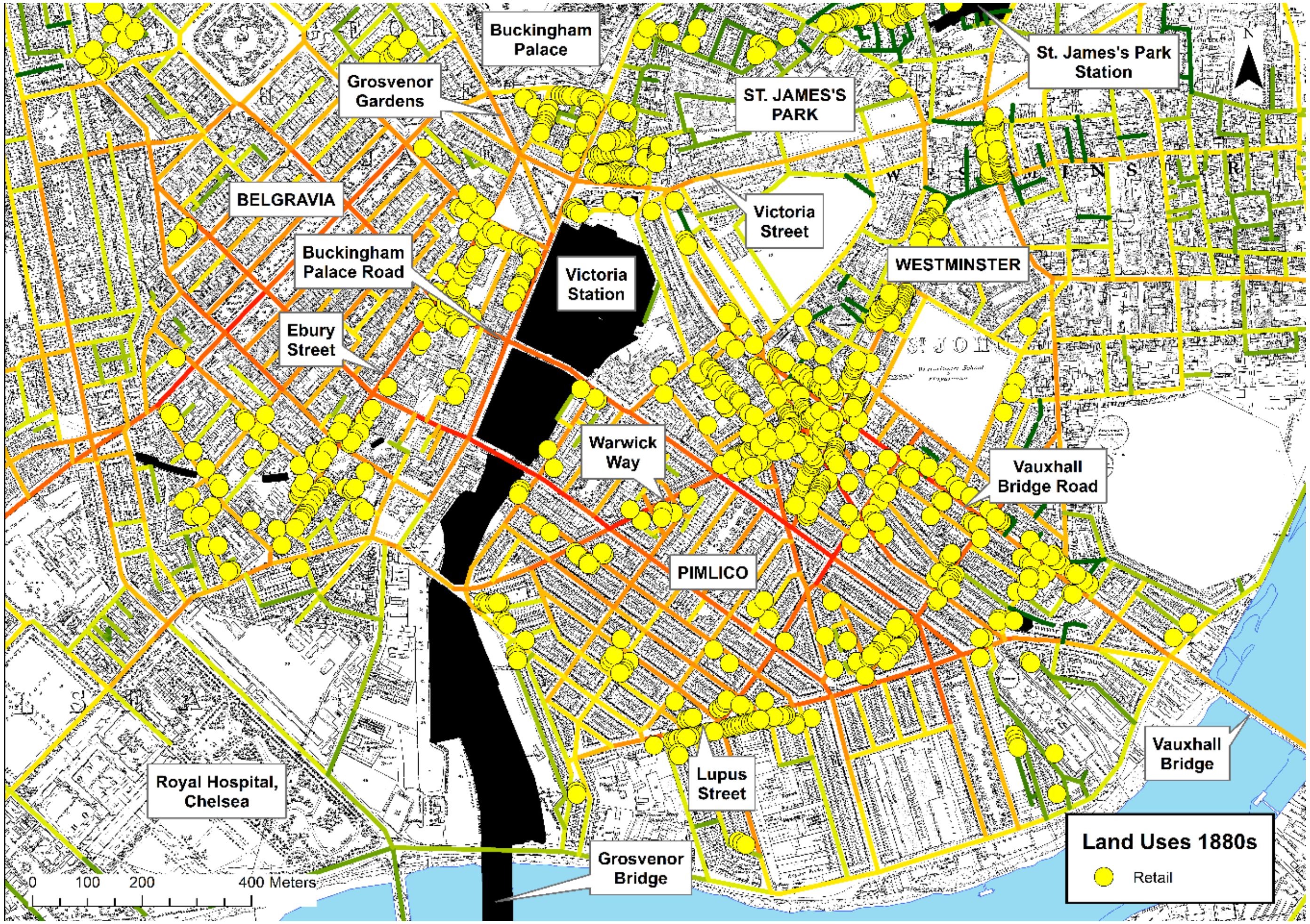

Figure 8.16: Victoria retail 1880s.

Figure 8.17: Victoria retail 2010s.

Figures 8.16 and 8.17 show retail premises. The location of shops is likely to be influenced by the number of people passing on their way to and from the station. The north-eastern half, between Vauxhall Bridge Road and Eccleston Road (the northernmost bridge over the lines behind the station), has higher local Integration values and a concentration of retail premises around the junctions of Warwick Way, Wilton Road and Vauxhall Bridge Road.

In the 1880s, retail was clustered around the front of Victoria Station. It was also located on a number of main routes within each neighbourhood – Ebury Street in Belgravia, Warwick Way and Lupus Street in Pimlico, and a number of Westminster streets further from the station, closer to the river and old centre. There is a particular cluster at the junction of Warwick Way and Vauxhall Bridge Road, where high Choice through routes meet high Integration streets.

The pattern in the 2010s is similar. There are new retail clusters, particularly around Sloane Square at the south-western corner of Belgravia. Victoria Street has become shopping street, completing a process that was only just beginning in the 1880s. The high Choice junction at Vauxhall Bridge Road has grown in significance.

Image 8.3: Lupus Street, Pimlico.

Local Integration values have fallen in southern Pimlico since the 1880s and there are now fewer non-residential uses to be found. Lupus Street, however, remains a local centre despite its Integration values falling as it approaches the barrier of the railway lines. It has a series of mainly independent shops, with small footprints compared to those found in front of Victoria – characteristic of streets found behind railway stations which form part of a disconnected grid. The northern side of Lupus Street consists of the original Cubitt buildings, while the southern side is occupied by the blocks of the Churchill Gardens Estate, which have shop units at ground floor level within low-rise residential slab blocks.

Figure 8.18 shows industry in the 1880s, and Figure 8.19 shows offices in the 2010s. These two uses are juxtaposed to show the substantial changes in the character of the neighbourhoods between the two periods. There has been an almost total disappearance of industry in the area since the 1880s. In contrast, offices barely existed as a category in the 1880s and are now dominant.

Industry was found behind Victoria Station to the western side of the railway tracks, the site of former canal wharves. It also occupied large riverfront sites in Pimlico. Westminster was a significantly industrial area too, later providing large sites on which offices were constructed to house Government departments.

By the 2010s there is a clear division between areas where office blocks are found and where they are not. The majority are around the station itself, around the edges of Belgravia, along Victoria Street and distributed across Westminster. These places are where the large offices, but also shops, theatres, and hotels are found, as would be expected of central London.

In Pimlico offices are concentrated in the northern streets, which have high Integration values and are closest to the station front, have offices – there are far fewer to the south. Warwick Way is a dividing line, and south of this street Pimlico is now predominantly residential.

South of Ebury Bridge, the area next to the railway has filled with railway-side housing occupying the former route of the canal. There are also institutional and industrial buildings: the Lister Hospital, British Transport Police headquarters and a large Victorian pumping station building. These sites are on former railway land beside the tracks and are separated from the rest of Belgravia by the Chelsea Barracks site. They are closer to Pimlico, but some distance from Victoria Station itself. At the point where the railway crosses the Thames via Grosvenor Bridge the station is a full 15 minute walk away.

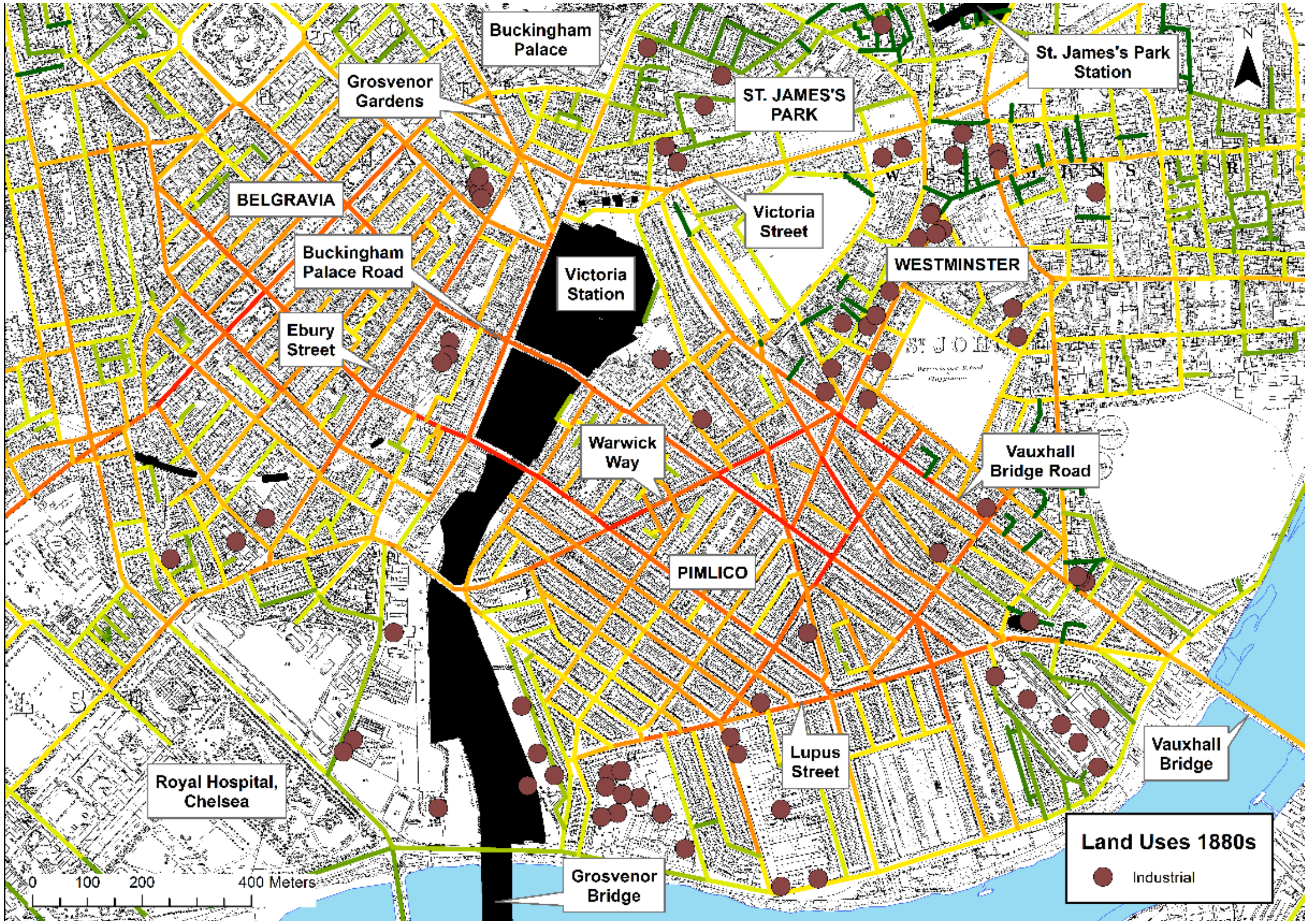

Figure 8.18: Victoria industry 1880s.

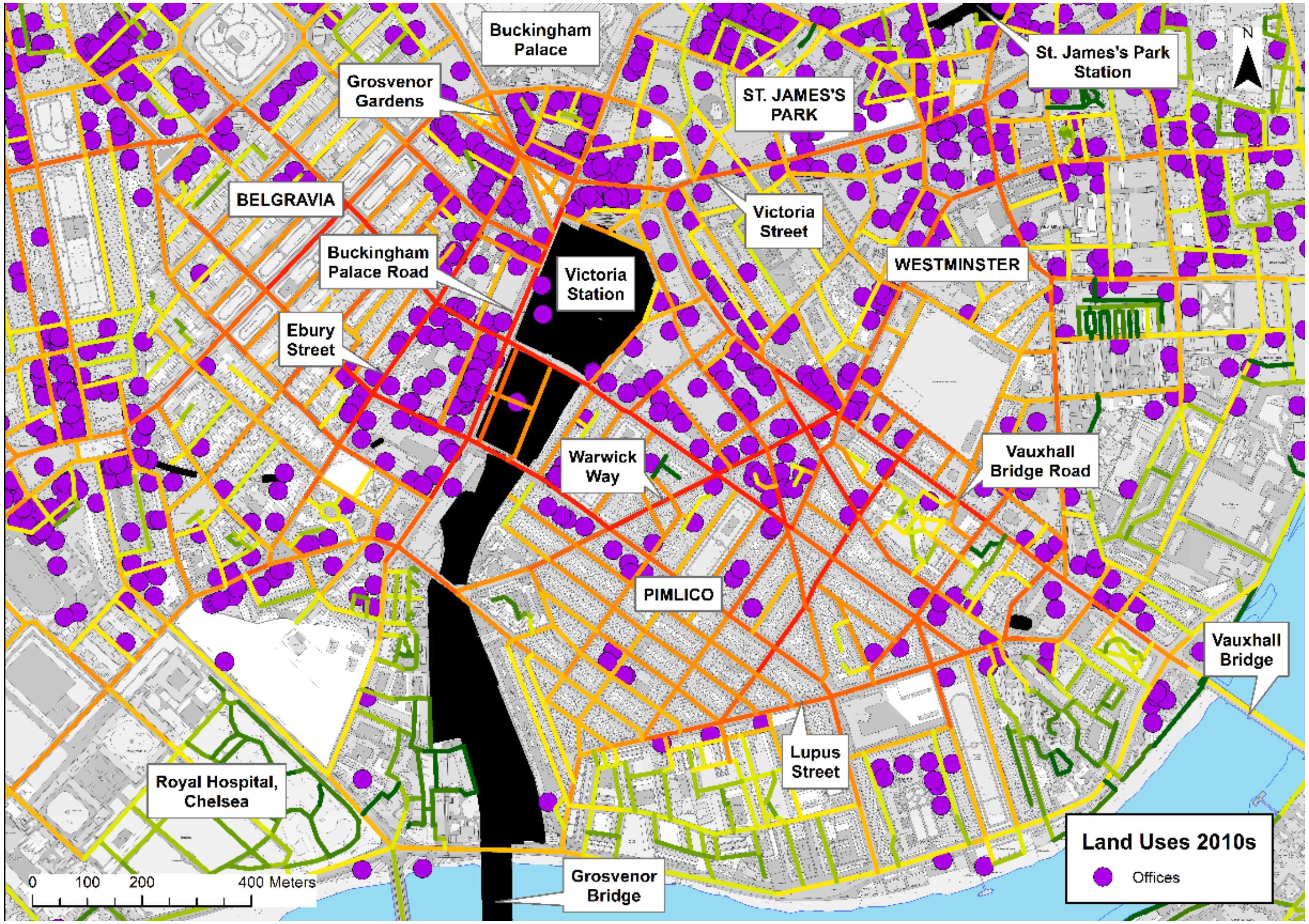

Figure 8.19: Victoria offices 2010s.

	Mean Choice 3000m	Mean Integration 800m
1880s Belgravia	241596452	7467
2010s Belgravia	17880160	2370
Percentage change	**-92%**	**-67%**
1880s Pimlico	201702239	8644
2010s Pimlico	15770160	2900
Percentage change	**-93%**	**-55%**
1880s Westminster	232429006	5579
2010s Westminster	19066681	2665
Percentage change	**-93%**	**-55%**

Table 8.4: Victoria non-residential land use values, 1880s and 2010s.[72]

In all three neighbourhoods, mean values for non-residential values at both Choice 3000m and Integration 800m are much lower now than they were in the 1880s. Mean Choice in particular has fallen substantially. Patterns of change are similar for all three areas. Overall, the lowest mean Integration values are found in Belgravia, and the highest in Pimlico. However, the distribution of land uses types varies considerably between neighbourhoods.

Table 8.5 shows the count in each neighbourhoods for land uses with more than ten instances in at least one of the areas. Pimlico was the centre for accommodation in the 1880s and remains so; Westminster for eating; Belgravia and Westminster for offices. Retail is spread relatively evenly among the three areas although not, as discussed above, within each area. The number of pubs has fallen in both Pimlico and Westminster. For reasons discussed above, the 'services' category has almost ceased to exist in these areas. All three areas are now dominated above all by residential uses, which was not the case in the 1880s, and the industry found then has largely disappeared.

[72] Lowest value of the three neighbourhoods shown in red, for ease of comparison.

Land Use		Count
Accommodation	Belgravia 1880s	97
	Pimlico 1880s	123
	Westminster 1880s	5
	Belgravia 2010s	31
	Pimlico 2010s	64
	Westminster 2010s	14
Eating	Belgravia 1880s	11
	Pimlico 1880s	13
	Westminster 1880s	40
	Belgravia 2010s	74
	Pimlico 2010s	67
	Westminster 2010s	95
Industrial	Belgravia 1880s	40
	Pimlico 1880s	52
	Westminster 1880s	180
	Belgravia 2010s	26
	Pimlico 2010s	5
	Westminster 2010s	12
Offices	Belgravia 1880s	8
	Pimlico 1880s	10
	Westminster 1880s	70
	Belgravia 2010s	1441
	Pimlico 2010s	323
	Westminster 2010s	1542
Public houses	Belgravia 1880s	25
	Pimlico 1880s	35
	Westminster 1880s	112
	Belgravia 2010s	25
	Pimlico 2010s	15
	Westminster 2010s	25

Retail	**Belgravia 1880s**	264
	Pimlico 1880s	353
	Westminster 1880s	568
	Belgravia 2010s	558
	Pimlico 2010s	429
	Westminster 2010s	485
Services	**Belgravia 1880s**	18
	Pimlico 1880s	158
	Westminster 1880s	207
	Belgravia 2010s	18
	Pimlico 2010s	6
	Westminster 2010s	21

Table 8.5: Victoria front areas, non-residential land use counts, 1880s and 2010s.[73]

Table 8.6 shows land use density, mean uses per segment and mean segment length per use. The density of non-residential land uses has fallen across all three areas since the 1880s. However, it has fallen substantially further in Pimlico that in the other neighbourhoods. This pattern is repeated with mean segment length per use, with the average distance between each use increasing by a much larger figure in Pimlico than in Belgravia or Westminster. This suggests that Pimlico has become disproportionately less varied, with sparser distribution of land uses and longer street segments with less activity located on them other than housing. As the maps have shown, this effect is seen particularly in the areas of Pimlico furthest from the station, located between the railway lines and the Thames.

The Shannon Diversity Index, however, shows a higher level of diversity in Pimlico compared to Belgravia and to Westminster. In the 1880s Westminster had a higher diversity figure than Pimlico, but their positions had swapped by the 2010s, while Belgravia had also experienced a greater fall in diversity than Pimlico. This measures suggests that while land uses have thinned out and reduced considerably behind the station, the uses that remain represent a wider range of types than in the other two Victoria neighbourhoods.

[73] Lowest value of the three neighbourhoods shown in red, for ease of comparison.

	Mean uses per segment (weighted by segment length)	Mean segment length per use (m)	Shannon Diversity Index
1880s Belgravia	37.2	0.1	1.30
2010s Belgravia	29.4	0.2	0.94
Percentage change	**-21%**	**139%**	**-28%**
1880s Pimlico	34.3	0.1	1.44
2010s Pimlico	15.7	0.5	1.12
Percentage change	**-54%**	**450%**	**-22%**
1880s Westminster	28.8	0.07	1.47
2010s Westminster	25.4	0.1	0.95
Percentage change	**-12%**	**99%**	**-36%**

Table 8.6: Victoria non-residential land use density, 1880s and 2010s.[74]

[74] Lower value of the two time periods shown in red, for ease of comparison.

Social analysis

Social analysis has been carried out for the Victoria neighbourhoods, using separate methods for the late nineteenth century and for the early twenty-first century. Figure 8.20 shows the 1898 Booth Map for the area.

Westminster is a socially mixed area, with the wealthiest categories found either side of Victoria Street and, and the poorest immediately adjacent to the east – the remains of the slums cleared for Victoria Street. Booth describes Belgravia as “with the possible exception of Mayfair, the yellowest district in London” (Booth, 1902, B362, p. 71), by which he means the least mixed and most consistently wealthy, with no street classified as black. Despite this there is still some poverty in Belgravia which, Booth notes, “all centres in the area bounded by Cliveden Place, Elizabeth Street, Holbein Place and Pimlico and Buckingham Palace Roads” (Booth, 1902, B362, p. 73) This is in fact the part of Belgravia located closest to the inaccessible railway spaces behind Victoria Station, in a corner created by the railway and Chelsea Barracks. The streets in this quarter of Belgravia are interstitial, characterised by older courts and blocks where demolition is already beginning. Booth notes that “the district is too central to be given over to the poor” (Booth, 1902, B362, p. 73).

Image 8.4: Pimlico grid from Warwick Way.

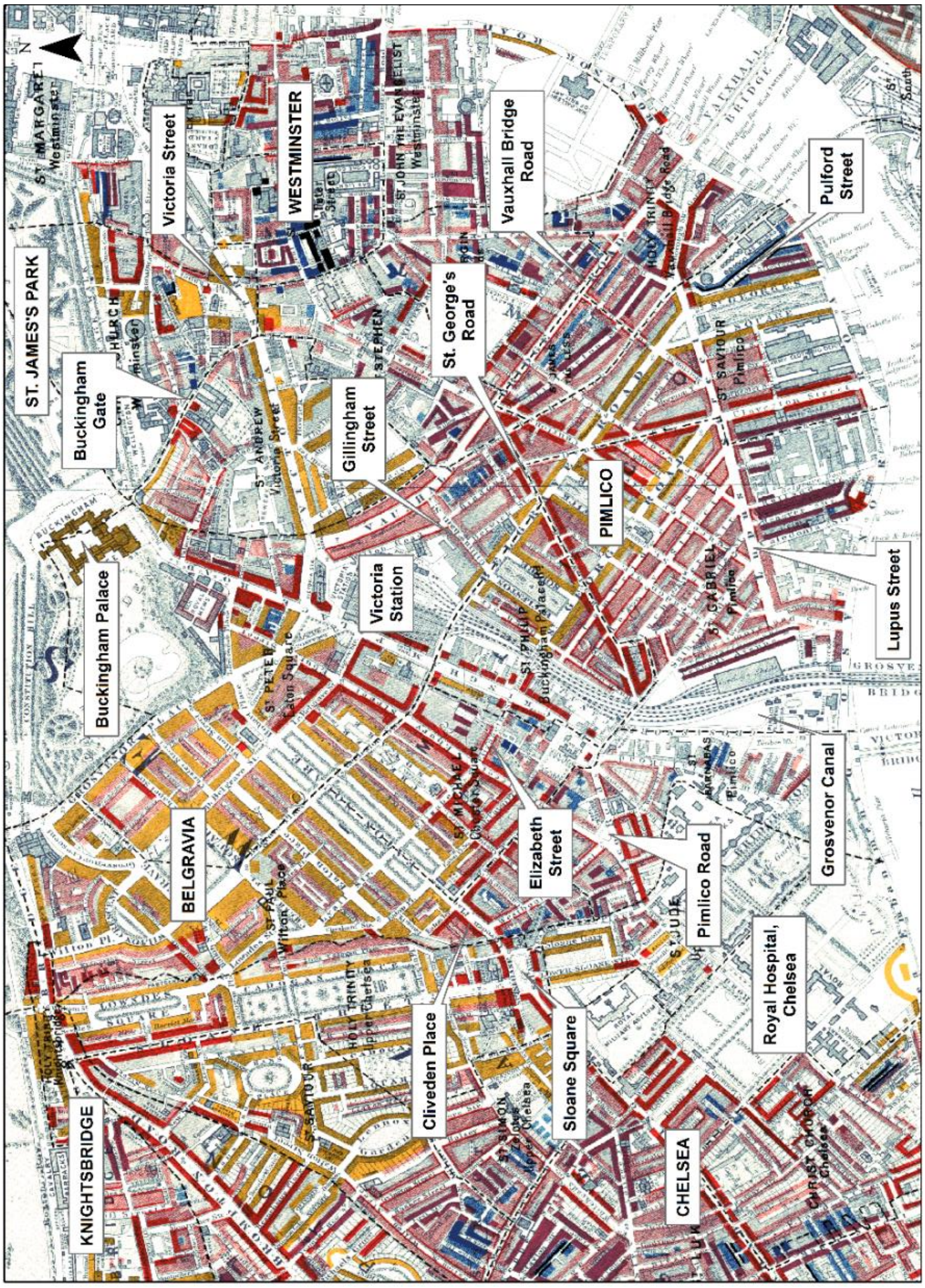

Figure 8.20: Victoria 1898, Charles Booth Poverty Map. [75]

[75] Source: Charles Booth Online Archive, London School of Economics. Labels added for the purposes of this study.

Pimlico is predominantly pink and red on Booth's maps, with only single streets marked black or dark-blue – notably located around the edges of the district. However, the Booth notebooks reveal that Pimlico, as well as the streets around the block that contains Victoria Station, were notorious for prostitution. Booth's investigators' assessment of this area is that "The salient feature of this district is clearly the extraordinary number of prostitutes who live in it... the area which fairly swarms with them is that bounded by St. George's Street, the railway, Westmoreland Court and Lupus St… it is not a district in which the neighbours complain of the traffic" (Booth, 1902, B362, p. 31).

This lack of vehicular movement matches the lower Integration values in the southern Pimlico grid. The combination of a grid-like street pattern, however, and relative segregation is associated with some of the "socially marginal activities" identified by Vaughan (2005) in Soho (albeit without the same creative element). The Booth notebooks are damning: "Unspeakably depressing… nowhere else in London have I received such an impression of shabbiness" (Booth, 1902, B362, p. 35). Relevantly, the only comparison the surveyor is able to make is with an area alongside the railway tracks behind Paddington Station. Booth's account provides information which places the numerous hotels and guest houses in this part of Pimlico in a different light.

Most of Pimlico is included in "the great prostitute patch east of St. George's Road" (Booth, 1902, B362, p. 33). It seems that prostitution takes place here both because of a combination of proximity to customers and affordable rents – in contrast to Belgravia, where property is more expensive and none of this activity is reported. Streets closer to Victoria Station have a similar character, with Vauxhall Bridge Road described as "a parade for prostitutes" (Booth, 1902, B362, p. 7) and Gillingham Street being "notorious for brothels" (Booth, 1902, B362, p. 7). However, the police guide accompanying Booth's surveyor also suggests that many of the women living in Pimlico worked in Soho and the West End. Prostitution was particularly found in the Pimlico streets nearest the railway approaches, and a similar phenomenon is found on Buckingham Palace Road and in streets in Belgravia's 'poor quarter'.

The Booth notebooks also describe small areas of severe poverty south of Lupus Street – the most segregated area of Pimlico, bounded by the railway to the west and the Thames to the south and east. Here the neighbourhood is judged to be in social decline. The lowest rated streets in the district, Pulford Street and Pulford Place were next to a gas works. They are coloured black and dark blue and have "a bad name, especially at the north end... many gas workers here, a very rough lot" (Booth, 1902, B362, p. 15).

Table 8.7 shows the whole area dominated by the top three property classifications.

Booth Class	Neighbourhood	Count	Segment Length	Choice 3000m	Integration 800m
Yellow	Belgravia	911	260	271353944	7147
	Pimlico	405	49	326379083	7429
	Westminster	357	44	217038325	3985
Red	Belgravia	863	167	354441128	6778
	Pimlico	1086	56	317295189	8403
	Westminster	833	39	376901096	5081
Pink	Belgravia	965	173	139972273	5351
	Pimlico	1271	51	257733515	7395
	Westminster	1241	40	327395111	5177
Purple	Belgravia	169	99	32314336	3159
	Pimlico	209	48	99152147	4932
	Westminster	434	45	305583954	5757
Light Blue	Belgravia	87	91	41064572	3127
	Pimlico	120	48	74982374	4206
	Westminster	182	32	209187504	4267
Dark Blue	Belgravia	37	96	2141978	1808
	Pimlico	29	6	198568309	1103
	Westminster	181	39	244607274	5152
Black	Belgravia	0	0	0	0
	Pimlico	35	54	21489285	2905
	Westminster	35	32	623871995	5450
Mean	Belgravia	N/A	**190**	**228456654**	**6041**
	Pimlico	N/A	**52**	**266367408**	**7364**
	Westminster	N/A	**41**	**312125693**	**5055**

Table 8.7: Mean spatial data and Booth, Victoria, 1898.[76]

[76] Lower value of the two time periods shown in red, for ease of comparison.

The greatest poverty is to be found in Westminster. However, Pimlico and Westminster share the same number of black segments. The poorest streets in Pimlico have lower Choice and Integration values than their equivalents in Westminster.

The highest Choice values at 3000m belong to the Purple and Light Blue and Dark Blue categories. The highest Integration values at 800m are linked to a wider range of social categories, but the highest are on the wealthier categories of street. Wealthier streets are on average more secluded than poorer streets, which reflects the distribution of poorer areas around the edges of the neighbourhoods, closer to the main through routes, the pattern noted by Vaughan and Geddes (2009).

Figure 8.21 shows clearly that, in the 2010s, almost all of Belgravia falls into the highest income bracket. In Belgravia the only exceptions are the 'poor quarter', in the same location identified by Booth, closest to the railway. This is still the only area of Belgravia where estimated mean incomes fall outside the top bracket. The highest income category is not found at all in Pimlico or Westminster. In Pimlico, the LSOAs with the lowest income are also in the areas noted by Booth, by the river, along Vauxhall Bridge Road and above all close to the railway and the river.

In Westminster, there is also close correspondence between relative lack poverty 2007/08 and the 1890s. The lowest income LSOAs are on the site of the 'Devil's Acre' slums, cleared nearly 150 years earlier. The estates built in the same location have maintained a relative income difference across a long period of time. Lower income LSOAs are all associated with estates, all built since the 1880s and most since the Second World War. These are disproportionately located closest to the railway lines and in the least accessible areas behind Victoria.

Table 8.8 shows spatial data by estimated GLA income band. Because the sample is small, the potential for comparison between neighbourhoods is limited. The contrast between Belgravia and the remaining two areas is clear, with most Belgravia street segments in the top income category. Integration values for Pimlico streets are consistently higher than either of the other areas for all income brackets where comparisons are possible. However, there are some similarities with the spatial distribution of the Booth categories.

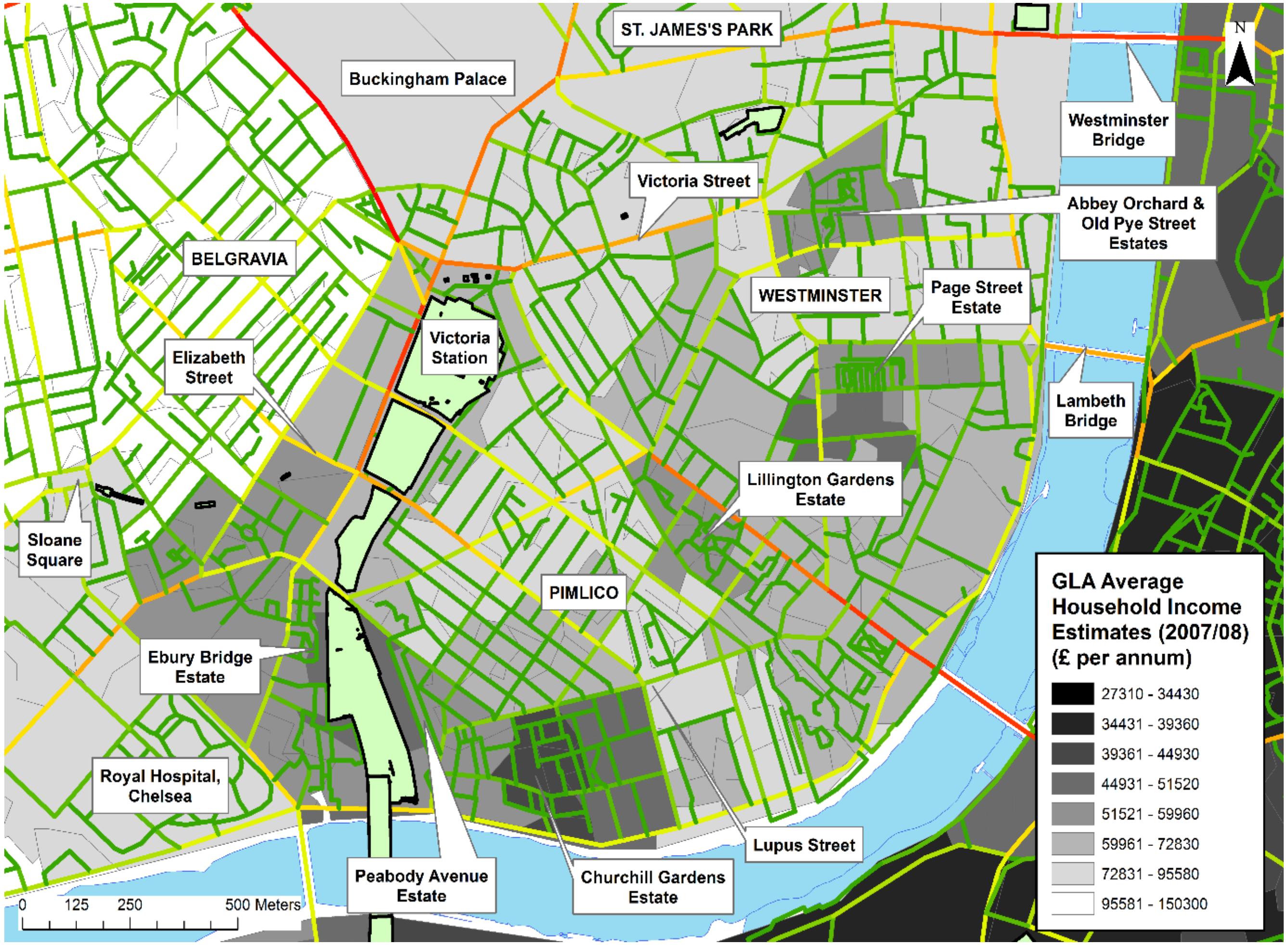

Figure 8.21: Victoria, GLA Household Income 2007/08, Integration 800m.

Mean household income	Neighbourhood	Count	Mean Segment Length	Mean Choice 3000m	Mean Integration 800m
£103,061-£162,220	Belgravia	27	85	604545958	8125
	Pimlico	0	0	0	0
	Westminster	0	0	0	0
£77,861- £103,060	Belgravia	6	80	1137669689	9257
	Pimlico	31	59	222252626	8642
	Westminster	21	63	247926875	5843
£62,981 - £77,860	Belgravia	3	79	639998234	5710
	Pimlico	46	59	412840609	8342
	Westminster	21	62	342452098	7463
£53,111 - £62,980	Belgravia	14	82	656752684	8829
	Pimlico	6	65	219079918	10429
	Westminster	12	62	351225553	6723
£45,431 - £53,110	Belgravia	4	85	1012990989	7086
	Pimlico	9	69	367825050	9860
	Westminster	6	63	352765827	6272
£45,430- £38,361	Belgravia	0	0	0	0
	Pimlico	5	72	128527496	9026
	Westminster	0	0	0	0

Table 8.8: Victoria, GLA Household Income 2007/08 with spatial data.[77]

The lowest income bands in Pimlico measured by Integration are the highest two and the lowest. The lowest measured by Choice are the bottom band. In Westminster, the highest band also both the lowest Choice and Integration values. Poorer LSOAs are found beside the railway lines, furthest behind Victoria, disconnected on two sides from the street grid, and in the centre of Westminster, furthest from main roads and where the streets are shortest and most poorly connected. Belgravia and Pimlico have integrated core grids which house relative wealth, while the edges of each area, where the grids break down are the least connected and the poorest. The street patterns of Westminster, not laid out as part of a single plan like Belgravia and Pimlico, exhibit more complex patterns of separation which pre-date the railway era.

[77] Lower value of the two time periods shown in red, for ease of comparison.

Discussion and conclusions

Victoria Station occupies a site that has formed a natural barrier between two different places for as long as we know. The construction of Belgravia and Pimlico, planned as separate neighbourhoods with separate identities came about partly through necessity. It was not possible to unite the two developments either side of the inaccessible railway strip between the Thames to Victoria Station. Westminster, with an identity of its own and a much longer history than any other part of the area, only became fully linked to Victoria Station in the 1860s when Victoria Street provided a direct connection.

The Victoria Station neighbourhoods have undergone differing types of change between the 1880s and the 2010s. Belgravia and Pimlico, built over the same period by the same builder, are valuable case studies for comparison. Analysis shows that Belgravia is more connected to through routes than Pimlico, and that its streets are more integrated at local level. Pimlico, relatively segregated in comparison, has always been a less desirable location – never the 'South Belgravia' originally envisaged by Cubitt (MacDougall, 2009).

The patterns of land use around Victoria in the 1880s and the 2010s illustrate the altered character of the area. The station's exits, on Buckingham Palace Road, Terminus Place, and Hudson's Place, connect to the area around the station frontage, the focus of central business district uses. North Pimlico has a central London character but much of Pimlico is hidden behind both the station and the railway lines. South of the line of the second bridge (Elizabeth Road) over the railway, Integration values fall.

The long, broad Victoria approaches are an off-limits space, forming an extensive barrier to movement. Pimlico is influenced most by this, with the station facing towards Belgravia and Victoria Street, turning away from Pimlico. The Pimlico area is further isolated by the Thames and the street layout of the housing estates around its southern edge. The result is an area that has become less integrated over time, with uses draining away from its more separated streets.

Grids form the core of both Belgravia and Pimlico, but the way each grid connects to surrounding streets is dictated by the railway space in between. Where each grid meets the railway, both spatial connectivity and socio-economic status decline. Less wealthy neighbourhoods persist in Belgravia, despite its being probably the richest neighbourhood in London. The building of social housing estates to replace Pimlico streets classified by Booth as poor seems to have fixed the geography of poverty.

Westminster has flourished since the 1880s, with extensive redevelopment, a concentration of government functions, new offices, shops and other city centre uses. Victoria Street, linking the station to Parliament, Westminster Abbey and Westminster Bridge, is the spine of the area and of its redevelopment. Despite, this, relative poverty still lingers in the same locations as in the 1880s, where philanthropic and council estates replaced slums.

Southern Pimlico has become less integrated during the course of the twentieth century, and more separated, with a reduced range of uses. The Victoria approaches have created a hinterland – an "urban void space" (MacDougall, 2009) – occupied by railway uses, and social housing located on awkwardly shaped sites. However, in southern Pimlico Lupus Street stands out. It retains the characteristics of a local centre, where businesses cluster in small premises with ground-floor retail space and, often, residential uses above. This street has similar characteristics to other streets located behind London terminals – a continuity of use as a local centre from the nineteenth century, small building footprints and floorplates and remaining Victorian building stock, and location at the edge of a grid that has experienced increasing spatial segregation behind a large station and its inaccessible approaches.

The next chapter draws together findings from the five analysis chapters, and applies them to the research questions set out in the Introduction.

Chapter Nine: Discussion and Conclusions

The following chapter summarises research findings across the case study terminals and discusses their significance. Findings are presented in the same order as in the preceding analysis chapters: firstly, historical analysis; secondly, morphological and network analysis; thirdly, spatial analysis; fourthly, land use analysis; and fifthly, social analysis.

Historical analysis

The historical analysis carried out for each terminus looks at the settings in which each station was built. It addresses the research question of the long-term impact of London railway terminals on their neighbourhoods by assessing how pre-existing conditions influence the location of stations and their approaches, and how they relate to its subsequent development and that of the surrounding city.

The sites on which London's terminals were built were not blank canvases: they were, of course, already places in their own right with individual historical and topographical characteristics. Although all were constructed at the edge of built up London, their sites were of different types. Euston and Paddington Stations were built on the closest available plots of undeveloped land to the north of London, at the limits of its growth by the mid-1830s. Their locations were determined indirectly by the boundaries of existing land ownership, as much of the land to the south of New Road (later Marylebone-Euston-Pentonville Road) was in the ownership of estates which had built up to the northern edges of their territory. Euston fitted into a remaining parcel of farm land already defined by development on four sides, adjacent to the development to the south, east and west, and further away to the north, at Camden Town. Its approaches therefore curve tightly around neighbourhoods which existed before the station arrived. Euston Station continues to expand into these areas, which occupy space adjacent to the terminus.

Paddington was built on a less constrained site, with urban development only on the east side at Paddington Green. However, the Paddington Basin canal was already in place so, together with the Harrow Road running across the north of the site, the station fitted into a landscape already shaped by existing infrastructure. The railway therefore not only separated Paddington Green from the future city neighbourhoods to the west, but also sat between central London and neighbourhoods that would later be developed to the north, reinforcing the Harrow Road corridor as a boundary. Later, this route would grow in importance as the main artery into London from the west, attracting transport infrastructure on an increasing scale and establishing the Paddington approaches as an area dominated by transport structures.

Victoria Station was similarly built in a close relationship to existing infrastructure, but in this case actually replacing an existing canal and basin. Belgravia had already been laid out to the west of the Grosvenor Canal, but the future development of the empty land to the east, later Pimlico, was influenced by the perceived impact of a railway on the desirability of new houses. Thus, although the station did not cause destruction of existing property, it did fix in place an urban boundary which led to Pimlico's design as a subsidiary neighbourhood, more suited to the back than the front of a station.

The first terminus, London Bridge, was built on the edge of the city but occupied a different type of site from Euston and Paddington. Although Bermondsey marked the southern city limits, the new railway penetrated to the heart of the developed area at the foot of London Bridge, a settlement as old as the City of London itself. It therefore crossed three-quarters of a mile of established streets. However, the use of viaducts meant that the demolition required for the route was relatively limited, with substantial clearance restricted to the station site itself.

The terminus at Waterloo was built in similar circumstances, with the lines carried over the streets of Lambeth on viaducts, reducing demolitions and street closures, although substantial demolition was still required. Lambeth was already densely built up so, like London Bridge, the viaducts enabled the station to take its place in an established neighbourhood. Because the station occupied a disused garden site, it fitted into a space that already formed part of the urban grain. However, the requirements of a station have meant that the railway has subsequently shifted and grown within its original, constrained site, leading to demolition of buildings and streets at the site's edges.

King's Cross and St. Pancras Stations, built later than their neighbour at Euston, were more destructive projects. Because development had moved further north of Euston Road-Pentonville Road by the 1850s, demolition was required for the King's Cross approaches to reach the smallpox hospital site occupied by the station. The site was constrained by existing development to the east, west and south, and the site was also surrounded by infrastructure and industry, with the Regent's Canal and gas works adjacent. However, open land remained to the north. By the time St. Pancras Station was built, between King's Cross and Euston, the area was no longer the edge of London and no open land remained. However, the locations of the existing stations meant only a comparable site could compete with their services. The Midland Railway was therefore obliged to clear sites for its new terminus, goods station and approaches by purchasing and demolishing Agar Town and a number of St. Pancras streets. Thirty years later the Great Central Railway was also obliged to find a location to match what other terminals had to offer to build Marylebone Station. Its construction required greater expense and destruction of property than previous terminal projects, carving a route through what were, by the 1890s, established London neighbourhoods, and creating space for a goods yard in Lisson Grove.

Historical analysis illuminates the relationship between London's terminals and the city of which they form part. Each had different origins and all were built in locations that were, to varying degrees, already complex places. However, commonalities can be found among the types of infrastructure at each of these terminals. Stations served by embankments, cuttings and grade approaches have become part of broader transport corridors since their construction. At Paddington where the railway joined the route Regent's Canal and Harrow Road it now forms part of a long, multiple level barrier which creates a clear separation between the neighbourhoods on either side. At Euston, King's Cross and St. Pancras the proximity of stations and their approaches have led to a large area of railway lands, junctions and islands separated by lines with few crossing points. Combined with the canal network, these structures have greatly increased the spatial complication of these back areas since the stations opened.

However, Marylebone and Victoria Stations, also served by lines in cuttings and at grade, have expanded less and remained within their original settings to a greater degree. At Victoria, the pre-existing Grosvenor Canal already formed the edge of Belgravia. The railway reinforced a boundary that already defined surrounding areas. At Marylebone, despite the large amount of demolition required, the approaches at grade were shorter than at other terminals, with a tunnel carrying the lines under St. Johns' Wood. At both stations the approaches were introduced in an urban setting with little space for expansion, and with streets already either developed or planned across the station back areas. These greater constraints seems to have limited the extent to which these terminals attracted further transport structures after construction.

Both the viaduct terminals south of the Thames, London Bridge and Waterloo, required demolition of existing buildings when they were constructed. However, they occupy sites that were already positioned within the urban fabric and were not built on the edge of London in the same way as other terminals, but in the centre of existing places. Their approaches have not been reinforced as separators by the addition of further transport infrastructure, with little space for expansion. Their presence in pre-existing neighbourhoods and the elevation of their tracks means that they are not surrounded by inaccessible railway lands in the immediate vicinity of the station in the same way as other, non-viaduct terminals. However, when they have expanded neighbouring streets which, by the nature of a viaduct, are very close to the railway, have suffered.

Overall, the analysis suggests that the origins of London railway terminals are associated with the creation of areas dominated by transport infrastructure and of distinct, separate front and back station areas. The comparison between two time periods more than a century apart allows the origins of stations to be related directly to the circumstances of the terminals operating in London today, and of their neighbourhoods. Theories of front and back are shown to be more nuanced than the 'wrong side of the tracks' stereotype would suggest, but there is reason to suppose that the character of neighbourhoods built after the arrival of terminals was influenced by their presence, and that the introduction of stations into existing neighbourhoods affected their development beyond the immediate destruction caused by the arrival of the railway.

The process of change between the nineteenth and twenty-first centuries is not smooth, and the use of a diachronic approach means that information on what occurred between the two study periods does not form part of the analysis. It does not, for example, directly assess the changes to these stations and their neighbourhoods as a results of Second World War bombing. However, the origins of the terminals shed light on the continuity of spatial, economic and social conditions over long periods of time, as explored further below.

Morphological and network analysis

Table 9.1 summarises findings from the analysis in Chapters Five to Nine in the form of percentage change between the two periods studied over three different measures.

	Percentage change, 1880s-2010s		
	Station Neighbourhood	**Total number of blocks**	**Total number of segments**
Euston (cutting) **King's Cross (cutting)** **St. Pancras (embankment)**	Front	-9%	+22%
	Back	-22%	+83%
London Bridge (viaduct)	Front	-39%	+36%
	Back	-20%	-23%
Marylebone (at grade) and Paddington (cutting)	Front	-34%	-35%
	Back	-47%	-31%
Victoria (cutting)	Front (Belgravia)	-33%	+18%
	Front (Westminster)	-16%	+9%
	Back (Pimlico)	+42%	+52%
Waterloo (viaduct)	Front	-37%	+16%
	Back	-30%	+44%

Table 9.1: Summary morphological findings.[78]

Morphological analysis provides evidence that be applied to the research question of what the long-term impact of London railway terminals is on their neighbourhoods, by looking at whether urban form has changed in different ways either side of terminals. Railway terminals are by some distance the largest single buildings in central London, with Euston (95,850m^2),

[78] Percentage increase shown in green, percentage decrease in red.

St. Pancras (69,750m^2) and Waterloo (65,300m^2) the three largest stations by area, when their size is measured to include tracks and buildings to the nearest crossing street behind each station. However, their approaches further behind the stations, occupy even larger blocks. These are contained in cuttings, notably the Paddington approaches (124,875m^2), or on embankments, such as the King's Cross approaches (Maiden Lane Junction, 106,750m^2; Triangle Site, 80,097m^2). Even approaches that are, relatively, much smaller still fill large areas of city, such as those behind Victoria (48,212m^2). Despite occupying more space than any other blocks in central London these are voids in the urban fabric, inaccessible to the public (see below). Beyond the stations themselves, they lack street frontage, and can be crossed only at pre-determined points where bridges have been provided.

Image 9.1: Victoria approaches, looking south from Ebury Bridge.

However, a further element of the railway system in London is even larger. Viaduct systems, continuous brick arches supporting railway tracks, are not usually defined as buildings but they are by far the largest structures in central London. They may well qualify as the largest brick structure in Britain, with only competition on a similar scale only from the reputed 318 million bricks of the London sewerage system (Goodman and Chant, 1999). The viaduct system south of the Thames, linking Blackfriars, Charing Cross, Cannon Street, London Bridge and Waterloo East Stations and serving destinations as far out as Battersea, Deptford and

Loughborough Junction is the largest continuous set of viaducts in the capital – more than 11 miles long, with several branches. Several other long railway viaducts exist elsewhere in inner London – for example, the 2.5 mile viaduct carrying the approaches to Fenchurch Street Station and part of the Docklands Light Railway – as well as in separate locations further from the centre, including Brixton, Chiswick, Hackney, Leyton, Peckham and Shepherd's Bush. Although railway lines are easily overlooked, having no direct interaction with the streets around them or, beyond stations, with the general public, it can be argued that the influence of these buildings and systems on the city is in proportion to their size.

The limit of central London, marked out by the terminals, is also defined by other forms of edge transport infrastructure. The continuous urban motorway formed by the Westway and the Marylebone, Euston and Pentonville Roads is an example, as are the coach terminals clustered at Victoria, the bus interchanges at Euston, London Bridge, Victoria and Waterloo, and the canal junctions and basins at Marylebone, Paddington, King's Cross, and St. Pancras. These structures combine with the railways to reinforce the separation between front and back station areas.

Block size profiles have changed in different ways in front and back areas, as shown in Table 9.1. The total number of blocks has fallen since the 1880s in each area, with the exception of Pimlico. At the majority of terminals – Euston, King's Cross and St. Pancras, Marylebone and Paddington – the total has fallen further in back areas than in front. While blocks in front of these stations have remained relatively unchanged from the 1880s, contained within the same street grids, block profiles behind stations have often completely altered, primarily as a result of extensive post-war redevelopment. This type of change, reconfiguring street patterns and replacing terraced housing with stand-alone housing blocks, is found almost exclusively behind terminals rather than in front of them.

However, London Bridge and Waterloo have seen different redevelopment patterns. At these stations, the total number of blocks has fallen further since the 1880s in front areas than in back areas. Wholesale rebuilding along the Thames has altered block size profiles in the front areas of both stations, thinning out the dense morphology of small riverside blocks housing industry and wharves, replacing them with a combination of larger commercial and cultural buildings and new open spaces. This sequence of events are particular to the south bank of the Thames, and have resulted in a greater reduction in the number of blocks in front areas than at other terminals.

Image 9.2: Churchill Estate, Pimlico.

Victoria Station has also seen a different type of morphological change. Of the neighbourhoods surrounding the station, block numbers have fallen by the lowest proportion – only 16 per cent – in Westminster, which was already long established in the 1880s as a commercial, retail and government centre. Contrasting types of change have been seen in Belgravia and Pimlico: while block numbers have fallen in Belgravia, due largely to the redevelopment of sites along its edges, closest to Victoria Station, into larger commercial and housing blocks, the number of blocks in Pimlico has risen by 47 per cent. This reflects the complete redevelopment of the area between Lupus Street and the Thames, where large factory blocks were replaced by the multiple stand-alone housing blocks of the Churchill Estate (Image 9.2). The rest of Pimlico has remained substantially unchanged from the urban grain laid out by Thomas Cubitt. The railway occupied the route of a creek, later a canal, which separated land to the east and west before its arrival. While Victoria approaches did not originate the separation between these two areas, they cemented it in place.

Comparing change in the total number of street segments since the 1880s reveals different pictures of street network change in front and back areas. Euston, King's Cross and St. Pancras, and Waterloo have seen an increase in total street segments in both front and back areas, but a much larger increase behind, by 83 per cent behind the first three stations. This change reflects a fragmentation of the street grids in these reconfigured areas, creating many more, shorter streets in contrast to the relative stability of front areas. At Victoria, the number of street segments has increased on all sides of the station, but by the largest proportion – 52 per cent – in Pimlico, again reflecting the impact of the Churchill Gardens development.

At Marylebone and Paddington segment numbers have fallen in both front and back areas. The construction of Marylebone Station dates from the decade following the 1880s figures and, despite the redevelopment of the Goods Yard sites at both stations, it seems that the successive waves of railway construction and demolition have resulted in a net loss of street segments, a different pattern from that in evidence in other station areas.

At London Bridge, segment numbers have risen by 36 per cent in front areas with riverside rebuilding, but have fallen by 23 per cent in back areas, where reconfiguration of a dense street network with pre-industrial origins has reduced its complexity, despite the introduction of areas with modernist estate layouts.

Change in the number of blocks in each area since the 1880s, shown in Table 9.1, reveals varying levels of physical stasis and change either side of railway lines. Each set of station areas has its own local circumstances, but large scale post-war reshaping of neighbourhoods has taken place predominantly behind terminals and not in front of them. South of the river, redevelopment has taken place on a similar scale, but sharp front/back contrasts are not in evidence with post-industrial redevelopment the industrial South Bank taking place in front of stations as much as behind them in a way not seen on the opposite bank. The neighbourhoods behind London Bridge and Waterloo are the only two terminus case studies to see a higher reduction in block numbers in front areas than back areas.

These areas of analysis reveal evidence of substantial, planned change in certain types of area. It seems that the back areas of the terminals lined up along the northern edge of central London have seen rebuilding that has left them substantially different in morphological and street network terms to front areas. While its nature varies between places, but a difference can be seen between front and back at each station. This reveals the impact on the urban fabric of large-scale planning decisions which were intended to transform housing provision, but have also introduced wider patterns of difference reinforcing the existing separation created by infrastructure.

Parallel processes of change at work either side of terminals can be traced through the different trends in block size development. This finding allows the concept of linear urban change to be questioned. The discourse surrounding railway station development is one of continual progress, updating facilities and expanding capacity to serve greater passenger numbers. This view, applied not only to London terminals but also, by extension, to their neighbourhoods, obscures the reality of processes which are complex and interlocking. While stations expand, the places demolished to make space for new transport capacity contract. Station front areas benefit from increased connectivity and the greater numbers of people who can access them, but these benefits do not apply to back areas. Instead, local change in such places is dependent to a much greater degree on the needs of the national railway system and the wider transport network, and on the strategies employed to meet these. It is necessary to look beyond this development narrative to assess its overlooked, unplanned consequences. Further discussion below assesses the nature of these spatial configuration changes.

Spatial analysis

Table 9.2 summarises findings from the analysis in Chapters Five to Nine in the form of percentage change between the two periods studied over two different spatial measures. Spatial analysis provides evidence to assess whether distinct spatial characteristics can be identified in London railway terminal neighbourhoods, whether spatial patterns of change can be observed, and whether these provide indications of blight.

Railway infrastructure inevitably creates separation between areas on either side of the lines. This effect follows the route of the railway from a terminus all the way to its destination, but has a proportionately greater impact in areas of the densest construction, which tend to be the central urban neighbourhoods closest to the terminus itself. Cuttings can only be traversed using bridges, embankments via tunnels, and the station throat immediately behind a terminus can often not be crossed at all, unless either sunken or elevated. Viaducts create visible barriers, with the appearance of walls across the city. However, because they were designed to pass over a pre-existing street network, they interrupt it less. Their arched design means a street can pass beneath the viaduct at any given point along the entire route of the railway.

The form of a terminus ensures that the separating effects of railway lines are always found behind the station, and only occasionally also in front. The only terminals in this study with lines passing in front as well as behind are London Bridge and Waterloo, part of wider viaduct networks. All the other stations have exits to the front and sides, and railway lines occupying the space behind.

	Percentage change, 1880s-2010s		
	Station Neighbourhood	**Mean Choice 3000m**	**Mean Integration 800m**
Euston (cutting) King's Cross (cutting) St. Pancras (embankment)	Front	-6%	-3%
	Back	-33%	-16%
London Bridge (viaduct)	Front	-33%	-13%
	Back	-27%	+3%
Marylebone (at grade) and Paddington (cutting)	Front	-29%	-5%
	Back	+25%	-11%
Victoria (cutting)	Front (Belgravia)	-11%	-21%
	Front (Westminster)	+26%	-16%
	Back (Pimlico)	-28%	-39%
Waterloo (viaduct)	Front	-33%	-26%
	Back	-41%	-24%

Table 9.2: Summary spatial findings.[79]

The nature and extent of this separation is measured through spatial analysis. The analysis uses Choice measured at 3000m to assess changes since the 1880s in connectivity for through journeys to other destinations. It measures how well connected neighbourhoods are, on average, within the wider street network. Mean Choice values have fallen much further in back areas at Euston, King's Cross and St. Pancras – 33 per cent - and at Victoria – 28 per cent – than in front areas, reflecting growing separation of a street network located among 'railway islands'. The overall pattern is the same at Waterloo, but with less difference between front and back areas. At London Bridge values have fallen on both sides of the station, but slightly further in front areas, by 33 per cent. However, at Marylebone and

[79] Percentage increase shown in green, percentage decrease in red.

Paddington mean Choice values have fallen in front areas, but increased by 25 per cent in back areas. Here, the construction of the Westway appears to have made journeys across the area much easier, although more difficult within the area as discussed below.

Mean Integration values at 800m, which show how well connected these areas are for short journeys to local destinations, provides a clearer picture of contrasting spatial conditions either side of the stations. At Euston, King's Cross and St. Pancras, Marylebone and Paddington, and Victoria Integration values have fallen on both sides of the stations, but by a much greater proportion in back areas – as much as 39 per cent in Pimlico. However, at London Bridge, while values have fallen in front they have risen slightly behind (by just 3 per cent). At Waterloo, Integration values have fallen by around a quarter on both sides of the station.

Spatial analysis demonstrates different levels of configurational change either side of terminals, depending on the type of railway structure. At non-viaduct stations, Integration values have fallen further behind stations than in front. Back areas, separated in this way, are now much less well integrated than they were in the 1880s, while the same scale of change is not seen in front of these stations. Neighbourhoods behind stations have also lost connectivity to the wider street network through reduced mean Choice values, contributing to greater relative separation. The two viaduct stations, once again, do not fit this pattern and neither do Marylebone and Paddington. However, while the Westway overpass may have improved mean Choice in back areas, it also created a formidable physical barrier reinforcing the effect of the Paddington approaches, and impacting on Integration values, namely local accessibility.

Although highly visible, the impact of viaducts on the Choice and Integration of the neighbourhoods they cross appears to be less than that of more hidden, but more divisive, railway cuttings or of embankments, with fewer tunnels beneath than a viaduct. Where railway terminals are served by viaducts, there is less sharp contrast between Choice and Integration values in front of station and those behind.

The connections enabled by viaducts may not seem immediately beneficial. Streets passing through long tunnels under wide approach viaducts, at London Bridge and at Waterloo, appear forbidding and are seen by pedestrians as unattractive places. However, they are in fact high Integration routes, and play an important role in the closeness and accessibility of neighbourhood destinations. Their presence means that the neighbourhoods crossed by viaducts are less separated than those crossed by cuttings, embankments or lines at grade.

Such streets are often poorly lit, dirty and lacking in street level uses, despite regular vehicle and pedestrian traffic and arch spaces. The rebuilding of London Bridge Station (partially complete at the time of writing) has involved the permanent closure of two streets (Stainer Street and Weston Street) for incorporation into the station as passenger routes. This could be said to have been appropriated to benefit the station at the expense of the wider neighbourhood, as they are no longer available as public streets connecting under the railway lines.

Building Acts were introduced at the end of the nineteenth century to improve access to light and air regulated street widths, building heights and street connectivity. They led, as Vaughan describes, to new housing blocks that were spaced more widely apart and set back further from the street (Vaughan, 2008). Therefore areas subject to redevelopment during the first half of the twentieth century experienced changes to their spatial configuration not seen in established, wealthier neighbourhoods that were left relatively unchanged.

These spatial trends accelerated with the development of modernist housing estates, often as a replacements for slum housing, which replaced grids with more complex street patterns, consisting of more, shorter segments, multiple levels, separation of pedestrians and vehicles, greater segregation, and reduced accessibility. Hanson notes that, in Somers Town, the result has been an amalgamation of smaller blocks into “fewer and larger islands” (Hanson, 2000, p. 105) and that active street frontage has been removed, with estate blocks separated from pavements by open space and, often, fences.

The post-war redevelopment that replaced Victorian housing with modernist estates has contributed to a decrease in mean Integration values within neighbourhoods. This fundamental spatial change, dismantling existing grids and separating traffic from pedestrians, occurred disproportionately in neighbourhoods behind terminals.

The relative proportions of dead ends in each study cannot be compared in the same terms as space syntax measures. Dead ends are presented in each analysis chapter as a percentage of each street network, which is necessary because of the changing size of the network between the two time periods. As percentages themselves, these figures cannot be compared in terms of percentage increase. The absolute number of dead ends in each area is similarly not comparable, because neighbourhood street networks are different sizes. However, the patterns apparent in the case studies can provide further insight into changes in permeability.

Whereas back areas might be expected to contain more dead ends, in some cases the opposite is true. London Bridge has almost twice as many dead ends in front compared with areas behind, partly a result of the presence of the river as a barrier. However, Waterloo has the opposite pattern, with more dead ends behind than in front, so there are clearly different factors operating in each area. It seems that redevelopment behind Waterloo has created a larger network of dead end streets than at London Bridge, while the latter has redeveloped its riverfront in a less connected and accessible manner than the South Bank. While patterns in these places are harder to interpret, the greatest proportion of dead ends in back areas is found in the neighbourhoods behind Paddington and Marylebone, which are also the most segregated on others spatial measures. There are also more dead ends behind Euston, King's Cross and St. Pancras than in front, where neighbourhoods also seem segregated. Pimlico, behind Victoria, has a lower proportion of dead ends than front areas, reflecting the contrasting street networks either side of Lupus Street, with an intact, connected nineteenth century grid to the north and the Churchill Estate to the south.

Changes in street networks have altered the spatial configuration of neighbourhoods either side of stations. In the most extreme cases there is a sharp contrast between the nature and extent of this change in front and back areas. The replacement of Victorian with post-war street layouts has taken place predominately behind, rather than in front, of most cutting and embankment stations, in areas that are more separated from the surrounding city by railway lines and other infrastructure than areas in front of terminals. Housing estates in these locations display lower space syntax values with areas in front of the station. However, behind viaduct stations the pattern is different. Local scale Integration has increased rather than fallen in back areas at London Bridge, while at Waterloo there is no great difference between mean Integration values in front and back areas.

The combined effect of the different development trajectories apparent across the case studies has resulted in neighbourhoods becoming more spatially isolated over time, influenced by their location relative to a terminus. This effect, however, is not universal or unavoidable, and differs by infrastructure type. However, it can be argued that barriers such as railway lines are too significant ever to be removed, and substantial new connections across them are too expensive to prove practical. Railways are permanent features of the city, and, unless they are directly mitigated and addressed, so are their spatial effects.

Land use analysis

Table 9.3 summarises findings from the analysis in Chapters Five to Nine in the form of percentage change between the two periods in non-residential land use density and diversity. Land use findings provide evidence to address the research questions of whether economic patterns can be observed over time in terminus neighbourhoods, and whether London terminals blight neighbourhoods.

	Percentage change, 1880s-2010s		
	Station Neighbourhood	**Non-residential uses per segment**	**Shannon Diversity Index**
Euston (cutting) King's Cross (cutting) St. Pancras (embankment)	Front	+66%	-45%
	Back	+18%	-41%
London Bridge (viaduct)	Front	+66%	-21%
	Back	-26%	-6%
Marylebone (at grade) and Paddington (cutting)	Front	+83%	+33%
	Back	0%	-99%
Victoria (cutting)	Front (Belgravia)	-21%	-28%
	Front (Westminster)	-12%	-22%
	Back (Pimlico)	-54%	-36%
Waterloo (viaduct)	Front	-23%	-26%
	Back	-30%	-19%

Table 9.3: Summary land use findings.[80]

Having established the existence of spatial separation behind the study terminals, and its intensification over a long period of time, this thesis analyses land uses in the 1880s and the 2010s, to look for associated economic patterns. Table 9.3 shows percentage change in mean

[80] Percentage increase shown in green, percentage decrease in red.

non-residential uses per street segment, representing density of economic activity. The analysis shows different patterns of change either side of stations, but with variations among the study terminals. It also shows percentage change in the Shannon Diversity Index, representing land use diversity.

At Euston, King's Cross and St. Pancras non-residential density has increased on both sides of the stations, but by a much greater degree in front – 66 per cent compared to 18 per cent. At Marylebone and Paddington mean uses have increased by an even greater degree in front – 83 per cent – but have remained unchanged behind. At London Bridge the pattern is even more pronounced, with non-residential density rising by 66 per cent in front areas, but falling by 26 per cent behind.

At Waterloo mean uses have fallen by 23 per cent in front areas, but by 30 per cent in back areas and a similar pattern is seen at Victoria, with a fall in use density on all sides of the station, but by the largest proportion – 54 per cent – in Pimlico.

The analysis shows a consistent difference in non-residential land use density between front and back areas. At all of the study areas in front of terminals have greater land use density than areas behind, either increasing land use density by a greater proportion that back areas, or losing a smaller proportion of land use density than back areas.

Non-residential land uses are disproportionately reduced in areas behind such terminals, but they remain concentrated in remaining elements of pre-redevelopment street grids. This includes streets where the original Victorian building stock remains intact and shops with comparatively small footprints front on to streets. It also includes streets where this urban grain has been replaced or recreated.

Long-established local retail and market streets located behind terminals – Bermondsey Street (London Bridge), Drummond Street (Euston), Chalton Street (St. Pancras), Church Street (Marylebone), Lower Marsh (Waterloo) and Tachbrook Street (Victoria) – have retained higher local Integration values despite a reduction in values in the majority of streets behind stations. They all contain concentrations of non-residential activities, and particularly of independent businesses. The balance between separation from adjacent neighbourhoods, local connection to streets within the neighbourhood, proximity to stations and a denser pattern of small retail units seems to provide more sympathetic conditions for this form of economic life than in the remainder of the terminals back areas.

At two of the terminals, railway expansion appears to have played a part in causing the relocation of their neighbourhood centres from back to front areas. During the late nineteenth century, the main local high streets, Harrow Road and Westminster Bridge Road, respectively, were located behind Paddington Station and Waterloo Station. By the twenty-first century, although their spatial values had not changed disproportionately, neither street retained the same land use types. They appear to have lost their high street status and associated uses. Harrow Road had become part of the A40, a trunk road taking traffic to the Westway, an inhospitable setting for street-facing uses. Westminster Bridge Road had been split in two by the gloomy underside of the exceptionally wide bridge carrying the Waterloo approaches. The growth of both terminals over time, and the construction of associated infrastructure along the station corridor at the edge of inner London seems to have contributed to local centres moving to the front of both stations, to Praed Street at Paddington and to both Waterloo Road and York Road at Waterloo.

Non-residential land uses are also found in railway structures themselves. Railway arches, used predominantly for warehousing in the nineteenth century, have become well-used spaces. Seen as undesirable when first built, they now provide the main industrial location in the London Bridge area. Manufacturing activities are now found in few other places in the terminus areas. Railway arches have also become the location of a new market at Maltby Street, based around food production facilities, while the much older Borough Market occupies spaces woven under and around the railway viaducts west of London Bridge Station. They also provide commercial space across the South Bank and host a number of other uses, including theatres, pubs and restaurants. Arches are characteristic of this and several other parts London, and provide a type of space which was thought to be suitable only for certain types of activity, but is proving increasingly adaptable. The contribution made by railway arches to station neighbourhoods is in contrast to the other forms of railway infrastructure studied, which instead create urban void spaces.

The Shannon Diversity Index shows a decrease in land use diversity to varying degrees in all areas, except those in front of Marylebone and Paddington where diversity increased. The neighbourhoods around these stations show the greatest degree of change, with the largest fall found in areas behind. A similar pattern, with a greater fall behind than in front is found at Victoria. At Euston, King’s Cross and St. Pancras the fall in diversity is slightly larger in front of the stations. The two viaduct stations, London Bridge and Waterloo, have a lower fall in back areas than in front.

In back station areas, twentieth century redevelopment has created complex neighbourhoods with disproportionately reduced levels of non-residential uses, compared to areas that have not been restructured. In most cases these areas are located behind terminals, rather than in front of them. At Marylebone, Paddington and Victoria this pattern is matched by a reduction in land use diversity, and diversity has fallen by a substantial proportion behind Euston, King's Cross and St. Pancras. At London Bridge and Waterloo, diversity has fallen in back areas by smaller proportions. This suggests that the presence of cuttings and embankments can be associated with an increasing difference between front and back areas over time in terms of land use, while viaduct terminals do not show the same pattern.

The way that land uses have evolved in front and back station areas matches the 'wrong side of the tracks' concept to a certain degree. In each case study, front areas have fared better in terms of land use density since the 1880s. However, the percentage change in the Shannon Diversity Index shows different impacts on diversity of land use. There seems to be a connection between type of built form at each station and diversity, which has fallen less behind London Bridge and Waterloo Stations than in front areas. The railway arch system offers potential advantages in promoting land use diversity behind these stations.

Törmä suggests that the creation of a "landscape of diverse conditions and use options" (Törmä, 2011, p. 81) in cities depends on networks and spaces that enable land use diversity. He identifies three essential conditions for this to occur: an integrated street network; blocks that allow for semi-public as well as wholly private and wholly public spaces; and interfaces between blocks and streets that allow multiple circulation routes to develop, enabling casual encounters. Vaughan, Törmä, Dhanani and Griffiths suggest that a "finer grain pattern of accessibility" (Vaughan, Törmä, Dhanani and Griffiths, 2015, p. 99:11) relates to a flexible range of plot and unit sizes, which build resilience in urban systems. All these characteristics can be found in the railway viaduct system in London which, at any given point along its route, provides either a public route beneath or a space that can be used in ways that are not pre-determined. As a result, the street network remains connected and multiple circulation routes are available both beneath railway lines and alongside them, along what are frequently semi-public routes providing access to arches. Railway viaducts also create a supply of small units which, while they allow for business expansion into neighbouring arches, retaining their form and scale. None of these characteristics is applicable to the other types of railway structure studied in this thesis, and in fact they offer such advantages to a much lesser degree than the standard city street.

This diversity is proposed as an important factor in successful cities, linked by Marcus and Colding to resilience who promote the value of "allowing for change and thereby creating resilience through adaptability" (Marcus and Colding, 2011, no page number). Changes in land use diversity, such as those seen in the study areas, therefore have important consequences for cities. Marcus and Colding also suggest that capacity to adapt is determined by accessibility, a theory that is supported by the greater reductions in land use density and, to a degree, diversity, in station back areas (Marcus and Colding, 2011). Applied to London's terminus neighbourhoods, this suggests that the greater fall in local Integration values found behind stations is significant, and that the fact this is not found at viaduct stations is no coincidence.

Social analysis

Findings from the social analysis address the research questions of whether social patterns can be observed over time in terminus neighbourhoods, and whether London terminals blight neighbourhoods, by looking at whether areas behind terminals have become poorer over time compared with neighbourhoods in front of stations.

Contemporary income data, being unavailable at the house-by-house scale used by the Booth Poverty Survey, does not allow diachronic, statistical, comparisons to be made in the same way as for spatial and economic findings. It is therefore not possible to summarise the data with comparable figures showing percentage change between the two periods, and a summary statistical comparison of change is not presented in the same way as in the preceding discussion sections. However, broader assessments can be made of the distribution of poverty and wealth in terminus neighbourhoods, and spatial patterns compared.

In the 1880s, areas of poverty were found predominantly behind terminals. The areas behind Euston, King's Cross and St. Pancras were particularly poor neighbourhoods. Front areas were longer-established, with large areas owned by the Bedford Estate and designed for upper middle class and upper class inhabitants. Poverty in these areas is seen only in smaller concentrations around estate boundaries, where working class accommodation was located. A similar scenario separated relatively poorer areas behind Paddington from wealthy areas in front of the station. At Victoria, Pimlico was considerably poorer than Belgravia and although it had wealthy streets and squares at its centre, they were dominated by prostitution in the 1880s. Around London Bridge and Waterloo there is no separation between income levels, with only the largest of main roads in Red (Middle Class) category. The area where Marylebone would be built in the 1890s was at the centre of the largest concentration of extreme poverty in the entire area, around Lisson Grove.

The disadvantages of a location behind, rather than in front, of a London terminus can be traced back to the earliest days of railway construction, with the direct impact of construction work contributing to disruption which, in turn, was said to have resulted in permanent changes to the character of a place. They became, in some cases, dominated by the railways with, according to Kellett, Camden Town filled with railway hotels and boarding houses, with even the newsagents selling railway journals (Kellett, 1969, p. 248).

Neighbourhoods behind some stations, recorded by the Booth Survey as including concentrations of extreme poverty, were characterised as undesirable places to live as a direct result of the continuing presence of the railways, which created dirt through their operation and through associated industries, and disruption through continued expansion. For example, the Ampthill Estate behind Euston Station, designed for middle class professionals had declined socially during the mid-nineteenth century after the London and Birmingham Railway was built across it, demonstrating “the deteriorating effect of a main-line surface railway upon a residential neighbourhood” (Kellett, 1969, p. 252). Back areas also became the preferred locations for housing navvies employed to build the railway lines, and workers on the completed railway system, also affecting the social status of these neighbourhoods.

The Booth Survey records the negative impact of separation by infrastructure, including railways, on social conditions and proposes it as a contributory factor to poverty. Dyos believes that the assessments of the Booth surveyors were correct, with infrastructure – “a dock, say, or a canal, a railway line, or a new street” (Dyos, 1982, p. 141) – linked to the creation of the conditions which existence of extreme poverty. Dyos suggest that the environmental effect of pollution and disease from industry combined with the spatial effects of infrastructure to act “like a tourniquet” (Dyos, 1982, p. 141.) cutting off, his analogy implies, connections vital to sustaining the healthy life of a place. Stedman Jones supports this assessment, writing that “One great effect of railway, canals and docks in cutting into human communities [is] a psychological one... East Londoners showed a tendency to become decivilised when their back streets were cut off from main roads by railway embankments” (Stedman Jones, 1971, pp. 15-16).

However, the connection between this trajectory and the arrival of stations is not necessarily one of direct cause and effect. Kellett describes the condition of the land north of New Road (now Euston Road) which, prior to the 1840s railway boom, consisted of four adjacent areas of estate ownership: Somers Town, owned by Baron Somers; land behind St. Pancras Station, owned by The Brewer’s Company; today’s King’s Cross Central area, owned by the Church of

England; and land around Caledonian Road, owned by St. Bartholomew's Hospital. All of these areas were semi-developed edge land, at the boundaries of built-up London.

After over-optimistic budgeting which resulted in losses on the first phases of middle class housing, Somers Town had been downgraded to a working class development and subsequently became "notorious" (Kellett, 1969, p. 247). The Brewer's Company estate was, by the 1840s, "almost as bad as Somers Town" (Kellett, 1969, p. 248), while the Church and St. Bartholomew's estates "had only reached the stage… of exploitation for their building materials" (Kellett, 1969, p. 249). They contrasted with the estates south of Euston Road, "the inner estates (which) tended to remain intact to a surprising extent" (Kellett, 1969, p. 244). This sharp social contrast was emphasised by the Duke of Bedford's decision in 1826 to erect gates around Bloomsbury "for protection from the contamination of Camden Town and Somers Town" (Olsen, 1964, p. 148).

In these areas patterns of wealth and poverty were set before the railways arrived. The choice of locations north of the Euston Road for new stations reflects the relative lack of development in comparison to the Bedford Estate land to the south, the status of these areas as less desirable, and consequently lower land values. These factors combined to make demolition for the railways a more economical and acceptable proposition on the north side of the road.

As terminus locations have remain essentially unchanged since the 1880s, they are also likely to remain relevant to interpreting social patterns in the contemporary city, as well the city of the late nineteenth century. The same divisions exist today, but in a polarised form. Areas south of the Euston Road are less residential than in the 1880s, with large houses converted for institutional and business use. Streets that containing the lowest income levels in the Booth Survey have improved their income status. North of Euston Road, the station back areas are dominated by the lowest two income brackets to as great an extent as they were in the 1880s.

Similarly, Pimlico was spatially disadvantaged by the railway even before building had begun. Because of its position on the wrong side of what were destined to become the tracks, it was planned from the outset as a socially distinct neighbourhood from its neighbour Belgravia. Its relative spatial isolation was a factor in Thomas Cubitt's decision about the type of housing the area could sustain.

Elsewhere patterns of poverty developed behind stations after construction. Paddington was constructed on the edge of the city, with the streets that now form its back neighbourhoods laid out after the station was built. The streets of Westbourne Square and the northern half of Paddington Green were Red and Pink during the 1880s, but were experiencing the beginnings of a long social decline, which took place after the railways were established. By the twenty-first century, the combined railway, road and canal systems defined areas of relative poverty which had expanded since the late nineteenth century, occupying redevelopment former lands.

The railway may have contributed to fixing distributions of wealth and poverty in place, by ensuring that these areas would be less desirable than contrasting areas which, although physically close, are poorly connected. The choice of sites behind stations for building social housing estates has also contributed to fixing their long-term status as lower income neighbourhoods. However, decisions to redevelop large areas were themselves directed by histories of relative poverty in these areas. The development of former railway land also created social housing estates in locations that were less desirable because of their proximity to railway lines.

Since the late nineteenth century, wealth and poverty have polarised spatially. The neighbourhoods behind stations still having predominantly lower incomes relative to the neighbourhoods in front. The separation is more clearly defined than it was in the 1880s, with less relative variety in income levels behind. The dividing line is clearest behind Euston, King’s Cross, St, Pancras, Paddington and Marylebone, while Victoria still separates wealthy Belgravia from poorer Pimlico.

However, at both London Bridge and Waterloo Stations poorer areas are nowadays found on both sides of the station. Where relative income levels have increased from the nineteenth century, they have done so in areas closest to the stations. The south bank of the Thames was poorer during the nineteenth century, less developed and more dominated by industry than the opposite bank. Nevertheless, the fine grained townscape of housing and manufacturing cheek by jowl was by no means unique, and is found in areas around the other terminals in this study. While the cuttings and embankments behind these stations now separate socially contrasting areas, the viaducts do not appear to play this type of role in separating richer from poorer areas.

The demolition of ‘slum’ areas, a process closely connected with railway construction, may have had the opposite effect. As Vaughan shows, in the 1880s East End of London overcrowding and concentration of poverty was exacerbated by the clearance of adjacent neighbourhoods” (Vaughan, 2008, p. 234). While the spatial exclusion of East End courts and alleys was blamed for the conditions and actions of the people who lived in them, their replacement with purpose designed social housing estates helped to fix the social characteristics of the same areas in place. The construction of estates in back station areas may be the direct cause of the persistence of relative poverty in those places, compared to front areas where no such extensive rebuilding took place. However, the locations for estate projects were determined by what was already there. Places seen as poorer were chosen for demolition and rebuilding, and those places were located disproportionately behind terminals. Separate processes can be seen at work: while all station neighbourhoods experience transformation over time, front and back areas have seen a different type of change, resulting in increasing separation between relative wealth and poverty, and polarisation by income level. This is an effect that, while apparent at each terminus, is less pronounced at the viaduct stations, than at cutting and embankment stations.

Summary of findings

The findings from these analysis approaches can be summarised and used to answer the research questions set at the beginning of the thesis.

The first research question asked what the long-term impact has been of London railway terminals on their neighbourhoods over time. To address this question, it was necessary to determine whether neighbourhoods surrounding London railway terminals had distinct spatial characteristics, and whether different spatial, social and economic patterns could be observed in these neighbourhoods.

The spatial definition of terminus neighbourhoods is addressed through historical, morphological and spatial analysis. Historical analysis sheds light on these questions through the origins of the terminals, showing that the sites they were built were all individually different, but that stations built on the edge of the city brought railway lines that formed the edges of subsequent development, and attracted further infrastructure over time to the routes they had created. Morphological analysis reveals different patterns of change in block size and numbers either side of stations, with redevelopment involving major neighbourhood reconstruction found much more behind stations than in front of them, but with different form of major redevelopment apparent along the south bank of the Thames, in front of London Bridge and Waterloo Stations. This change is coupled with network change, with street grids remaining intact in front of stations but becoming fragmented and disconnected behind them.

Spatial, social and economic patterns of change are addressed through respective forms of analysis. Spatial analysis reveals difference patterns of change either side of terminals, with Choice and Integration values falling by a greater proportion behind stations but, again, differing for London Bridge and Waterloo. Land use analysis reveals economic patterns of change that differ in several cases between station neighbourhoods, with back areas performing less well than front areas in terms of non-residential land use density and diversity behind Paddington and Marylebone in particular, and at other cutting and embankment stations to lesser degrees, a trend also not so clearly observable at the two viaduct stations. Finally, social analysis shows polarisation between front and back areas, with those in front becoming relatively wealthier and those behind relatively poorer, again not a trend found at the viaduct stations.

Dyos' characterisation of the "complete declension from meadow to slum" (Dyos, 1982, p. 141) in some neighbourhoods can be observed behind some terminals – Euston, King's Cross and St. Pancras, Marylebone and Paddington – but by no means describes an inevitable process of change. Where it can be seen to have occurred, the areas in question remain relatively poorer than those in front of the terminals. In the other case studies, this linear declension is not what took place, and more nuanced stories are apparent with areas already poor, such as at London Bridge, or becoming poor to only a limited extent, such as behind Victoria. The relationship between "successive railway loops" (Reeder, 1984, p. 7) and poverty can be seen in the case studies, but is clearer and more persistent where stations are served by cutting or embankments.

The second research question asked whether London terminals 'blight' their neighbourhoods, and to answer this is was necessary to determine whether any patterns of change discovered in these areas could be reasonably described as blight.

Blight can be local and site specific. The impact of railways on the long-term condition of station back areas is seen in the creation of hinterland areas and void spaces, occupied by railway uses. These are found behind each of the London terminals, as large stations require space maintenance and servicing. This is located alongside station approaches, but in the case of the viaduct terminals is elevated above street level. This means that it does not occupy otherwise potentially active areas of city, as it does at cutting and embankment stations. Such areas can be released for other use when no longer required for railway use, if they are at grade or can be connected to street level. However, there are several sites behind the terminals where social housing developments have been located on awkwardly shaped sites, next to active railway lines, including the Brunel Estate behind Paddington

Station and the Peabody Avenue Estate beside the Victoria approaches. The presence of the terminus leads to sub-optimal piece of city behind terminals because railways create hard, impenetrable spaces that are difficult to integrate with their surroundings.

However, the cumulative impact of such spaces can be neighbourhood wide. The fortunes and long-term rental prospects of adjacent areas could be radically altered by the presence of a terminus, as illustrated by the success of the Bedford Estate in Bloomsbury, retaining morphological and street patterns much closer to their original planned layout than former Bedford land behind Euston, where similar plans were frustrated by railway construction.

Railways are associated with long-term uncertainty, which could be described as a form of 'blight'. The Booth Survey identified instability in neighbourhoods behind stations which, by the 1880s, were more than fifty years old, with continuing expansion and alteration undermining the permanence of areas closest to the stations and tracks. The endlessly temporary nature of station back areas is further illustrated by the continuing uncertainty in the Drummond Street area, west of Euston Station, where the demolition for a new High Speed Two station was just beginning at the time of writing. With the potential for phased redevelopment of the existing Euston Station buildings following completion of the HS2 extension, as well as the further demolition in the area for the proposed Crossrail 2 Station, large-scale works are likely to affect the Euston neighbourhoods for the next twenty years. The impact will predominantly on areas behind the station. With regular transport expansion and upgrades needed to serve a growing London population it is likely that, just as throughout the second half of the nineteenth century, construction will be taking place in the vicinity of at least one of the study terminals at any given point for the foreseeable future.

The differential land use and social changes observed can be reasonably said to be evidence of blight where they have disadvantaged neighbourhoods behind terminals. This disadvantage may have been triggered by the railways, and perpetuated by other means, including spatial segregation through street network change. However, blight, in terms of uncertainty, increasing poverty and decreasing land use density and variety, is not the only consequence of a location behind a terminus. Spatial segregation can form part of a viable, functioning area. Vaughan's finding that a combination of spatially segregated areas with a street grid, such as in Soho, can create the conditions for marginal activities to thrive is particularly relevant to interpreting the settings of viaduct stations (Vaughan 2005). The role of the viaduct system in creating hidden pockets of small work and business spaces was viewed negatively in the nineteenth century, but contributes a valuable type of space to the areas behind London Bridge and Waterloo. Marginal activity can be not only positive, but essential in maintaining land use diversity and distinctive local character. Railway arches are beneficial spaces, with a high degree of flexibility, able to house almost any use. Spaces can be refitted to reduce the noise of trains and provide insulation, and a range of sizes is available through the use of one or several adjacent arches. As the main locations for industrial activities in station neighbourhoods, they supply working spaces that are becoming harder to find in London. Their growing popularity is a reflection of their long-term value to their areas, and demonstrates that in these situations the 'wrong side of the tracks' is not a relevant characterisation.

Neighbourhoods on the wrong side of the tracks suffer impacts from their proximity to terminus stations that will always attract the lion's share of attention, investment and prioritisation. They exist, in many ways, in their shadow, experiencing socio-economic consequences that originate in spatial disadvantage. However, within this overall trend are many nuances, and there is no reason to suppose that all such neighbourhoods fit a single typology, or that they are inherently inferior and in need of fundamental change. Being hidden in the shadows can be beneficial as well as problematic, and the character of places that have existed for a century or more next to a major railway station is shaped by their presence, both for better and for worse.

Research limitations

There are limits to the conclusions that can be drawn from the methodologies employed in this study. The selection of two periods for research, separated by 130 years allows long-term change to be identified. However, London has been a place of dynamic, transformative change over the period between the two analysis periods. Therefore, the methodology necessarily obscures the cycles of economic, social and physical development that took place between the two research periods. There are two particular points to note in relation to the diachronic methodology. The first is that the progression from the 1880s to the 2010s has not been a linear progressions. This point is particularly important in relation to the assessment of railway neighbourhoods that are now relatively economically successful and inhabited by those in higher income brackets. London as a whole experienced population decline between 1939 and the mid-1990s, caused by war-time damage, subsequent re-planning and economic change, and its revival is a phenomenon of the past 20 years. While the most central front station areas, such as Bloomsbury or Marylebone, only fell into limited economic decline, more peripheral neighbourhoods such as Bayswater, King's Cross or the South Bank were dilapidated until the late twentieth or early twenty-first century. For example, Street points out that "although the South Bank is now recognised as a cultural, visitor and commercial centre, until relatively recently many perceived it to be an 'under-developed' place with an 'image problem' (Street, 2014). This is not confined to back station areas: neighbourhoods in front of stations have also experienced changing economic fortunes.

The second point to note is that, from some perspectives, the 1880s and the 2010s could be seen as impossible to compare. The changes that have taken place in the last 130 years have encompassed every aspect of urban society and, although the study locations are geographically identical, there is little else about them that has not altered in ways both large and small. However, the apparent separation of contemporary society from a past version of London is also a strong argument for conducting research in this way. It is easy to dismiss the events of more than a century ago as irrelevant to decisions made today. However, the railway terminals and lines that we use today are essentially the same that were used in the 1880s. Above ground routes are substantially unaltered, with closures, additions and changes but, essentially, the same main routes following the same paths. Similarly, only one permanent London terminal has disappeared completely since the 1880s: the rest remain, rebuilt to greater or lesser degrees, but in the same locations. Railways are long-term pieces of city, almost impossible to relocate. The fact that their location has not essentially changed also allows the spatial variable in the research to be controlled at the city-wide scale. While locally there has been a significant change in street structure, the stations remain on the site they occupied when built. There is no reason to suppose, from an early 21st century perspective, that they will not be with us in another 130 years' time. Their influence therefore needs to be understood in the context of their longevity which, although inconvenient for standard political and planning cycles, is the reality of their urban presence. Acknowledging these limitations, the research methodology in this study has intentionally chosen two periods separated by more than century to provide a longer-term understanding than is usually available.

As noted in Chapter 1, the starting point for the analysis also inevitably incorporates a series of circumstantial influences on each location which were already in place before the stations were built. These include the physical constraints on each site resulting from landscape features. This is particularly apparent in relation to the River Thames, which clearly influences movement networks to a greater extent than any other natural feature in central London. However, the presence of parks and, to a limited extent, Thames tributaries also shaped and constrained the development of each terminal and the neighbourhoods around them, before the influence of the railways and after the railways had arrived. Man-made infrastructure has also played a role in shaping these neighbourhoods both before and after the railways, including both the Regent's and Grand Union Canals which pre-dated the terminals, and the road network which has developed substantially many decades after their construction. The situation of each terminus is different with particular local combinations of these features, which is a justification for critiquing the 'wrong side of the tracks' stereotypes and understanding each place in its own terms, enabling commonalities to be identified through analysis of the evidence.

Similarly, this thesis acknowledges the influence of invisible boundaries, particularly those created by land ownership and by local government, both before and after the construction of the railways. The contrast in urban grain as well as social and economic profile found either side of some terminals in this study reflects a wider contrast between areas in estate ownership and those without a dominant freeholder. They also reflect, to a lesser extent, administrative boundaries in different eras. However, the character of every London neighbourhood is influenced by multiple factors. While the 'edge' conditions found in many of the case studies is influenced by the location of boundaries such as these, equally the continued existence and significance of such boundaries is influenced by the proximity of terminals.

The choice of a local scale for analysis is necessary to ensure a practical scope for the research, but it places geographical limitations on the findings. It has not been possible to investigate the effects of the many miles of railway approaches that cross the city and connect London's terminals. These approaches run predominantly above ground and, given the clarity with which the separation effects of railway lines can be seen in the areas closest to terminals, it seems reasonable to expect similar effects elsewhere along the railway lines. However, further investigation would be needed to determine how far separation effects can be traced from stations, and whether the different location of neighbourhoods within the transport network or their distance from a terminus changes the effect. Equally, the relative lack of separation created by viaducts would need to be explored on a wider scale to understand whether they continue to be associated with better integration and connectivity in neighbourhoods further from terminals.

It would also be necessary to explore, beyond the local 800m scale used in this research, the extent to which the age of a neighbourhood is significant in influencing its relationship with railway lines and other infrastructure beyond central London. Many outer neighbourhoods were first built long after the late nineteenth century study period in this thesis, and may have experience a different trajectory of spatial change.

Finally, the environmental impacts of railway operations, while not investigated in this thesis, are potentially significant. Diesel powered trains create substantial pollution and, while vehicle pollution is high on the political agenda in London at the time of writing, railways are rarely discussed in this context. However, pollution maps of London reveal that the highest concentrations of nitrous dioxide emissions are found not only along main roads and at Heathrow Airport, but also along railway routes still operated by diesel trains: the Great Western Railway from Paddington, the Midland Railway from St. Pancras and the Chiltern Line from Marylebone (Mayor of London, 2010). The emissions from trains on these railway lines is comparable to that of a trunk road, but hidden from sight. Pollution from railways undoubtedly influences quality of life in these particular areas, and deserves further assessment.

Future implications

This thesis has set out to answer questions about the spatial, social and economic impact of London's terminus stations on their surrounding areas. It has demonstrated the long-lasting effects of the decisions taken in the mid-nineteenth century on the introduction of railways to London. Donald Olsen, writing in 1964, remarked that "No guidebook has ever suggested perambulating the streets and squares that lie immediately to the north of Euston Station" (Olsen, 1964, p. 63). His comment conveys a perception, still current, that London ends at Euston and begins again at Camden Town, missing out the neighbourhoods in between, hidden away behind Euston, King's Cross and St. Pancras Stations. A similar point could be made about many of the neighbourhoods located behind stations that are examined in this thesis.

The contrast between the bustle in front of Euston and the absence of activity behind remains unmissable. However, these station back areas are not widely recognised as such. The concept of a station front and back is widely understood, but only in terms of very immediate station surroundings. The idea that a station has an inverse, seedy side that attracts illicit activity was clearly true in the late nineteenth century, the era of the Booth Poverty Survey. By the early twenty-first century this aspect of London terminals has almost disappeared through the post-industrial redevelopment of station areas. But while London's terminals themselves are rebuilt, and their value as retail floor space recognised and put to work, places that are only a little further away still have back station characteristics.

The contrast seen at Euston can be witnessed to some degree in all the neighbourhoods behind the terminals studied in this thesis. Areas of London that are adjacent to each other remain separated, physically by the barriers created by railway lines and by other infrastructure; economically, with contrasting levels of shops, services and facilities; and socially, with income levels varying greatly over short distances. In some cases the social and economic contrast either side of the railway has intensified since the late nineteenth century. At several London terminals, the route of the tracks can be identified with only an income distribution map, revealing a clear contrast between the 'wrong' and the 'right' side of the tracks. This is the case where tracks pass through the city at grade, in a cutting or on an embankment, with minimal effort to manage their spatial impact. The areas surrounding the two viaduct terminals studied do not exhibit the same degree of separation. This difference is not solely a spatial one, as the south bank of the Thames was socially separated and poorer than the north bank when its stations were built, and to some extent remains so. However, there is evidence that the neighbourhoods of viaduct stations are significantly better connected, to their benefit.

The major changes in street configuration associated with poorer, more segregated station back areas have exacerbated these existing characteristics. Change in land use character, with a reduction in non-residential uses, can be associated with these street network alterations. There is likely to be a two-way relationship between these trends, with neighbourhood remodelling encouraged by the perceived lack of economic success in a particular area, evidenced in part by the disappearance of land use variety, and in turn encouraging further thinning out of uses.

A similar relationship is suggested between street configuration and relative poverty, with the street grids predominantly eroded behind terminals, locking poorer housing in place and separating it further from surrounding areas, cementing conditions that already existed in many areas. However, railway separation can also be associated with the decline of areas into relative poverty, and into a greater degree of relative poverty.

The nineteenth century arrival of the railways brought transformative social benefits by enabling efficient travel over much longer distances. They also had direct local effects, not only through the short-term impact of construction, much noted at the time, but also by dividing neighbourhoods in the way feared by some contemporaries. These effects persist today and, in some places, have deepened over the course of 130 years. Major short term change has been shown to be exacerbated and perhaps made irreversible in the long term. Railways are too expensive for substantial redesign unless there are clear passenger benefits, and their routes through the dense, historic fabric of a city such as London are essentially fixed. The planning timescales for major infrastructure change, long by planning and political standards, are still too short to capture the real consequences of such construction.

Although this research begins with railway stations, it raises spatial issues with potential impact beyond railways, including the impact of large buildings, of large and of small blocks, of front and back areas, and of public and private space. A number of the railway terminus neighbourhoods were once at the edge of their city. This is a long-forgotten phase in their development, but may still provide a useful way to reflect on the particular combinations of urban form and uses that have grown up, and a way to consider their evolving role.

A recurring feature of station back areas is their market streets. Perhaps as a consequence of the focus on stations as transport providers, local market streets in the shadow of large London stations are overlooked. Both despite and because of this relative neglect, they are some of the most characterful and least predictable streets in central London. Streets in station back areas which retain or have replicated Victorian plot size and street grid, match all the characteristics required, according to Jane Jacobs, for urban diversity. Jacobs identified four factors: a combination of small blocks and connecting streets to avoid areas that are separated; a mixture of buildings of different ages and conditions to support variety of us; a mixture of primary uses so that people use a place all day round; and a sufficient concentration of people, including residents, to support activity (Jacobs, 2000). All these are present in local station market streets.

Places such as Bermondsey Street, Chalton Street, Church Street, Drummond Street, Lower Marsh, Lupus Street, Tachbrook Street and even Eversholt Street are public streets outside the control of large landowners or developers, dominated by independent shops with market stalls to enliven the streetscape, a combination under threat in better known parts of central London. To some extent these streets represent a time lag, with change slower to reach them than other London locations, characteristics of both their lack of connection and their dependence on long-term station development plans. Bermondsey Street, connected under the London Bridge railway viaduct, retains its independent shops, restaurants and pubs but, unlike the other, more segregated examples, has experienced substantial social change over the past decade.

The shadow of a station also holds places in a state of edge land uncertainty. Drummond Street, to the west of Euston Station, is a current example of the way that the needs of national transport infrastructure override local concerns. Originally the street that ran across the front of Euston Station, Drummond Street was reduced to half its length when the expanded 1960s station blocked its route. The remainder of the street, with nineteenth century scale buildings and street grid, has become known for its Bengali population and restaurants, and for a small, diverse shops and alternative activities. Now it is scheduled for further demolition over the coming decade as Euston expands again.

This research has also uncovered the particular spatial characteristics of viaducts. London's railway arches play a definitive role in the shaping the form and character of large areas of the city and influencing the way that they function. Like railway cuttings they are often ignored: they are simply not seen, because they do not provide any interactive function with the city beneath. However, unlike cuttings, they have the potential to do so. London's railway arches are the object of increasing attention, as rents and property values increase, and have begun to attract uses that would previously have given them a wide berth. A recent edition of Time Out included an article on the "mixed blessing" of London's revived railway arches, with both the arrival of varied uses such as cafés, bars and studios, alongside higher rents (Time Out, 25 April-1 May 2017, pp. 20-22). The Better Bankside Business Improvement District is promoting a plan to create connected public spaces along the viaducts connecting London Bridge and Waterloo Stations (Better Bankside, 2015). This recognition of the value to the city of these incidental but highly beneficial spaces should extend to a wider consideration of the spatial role played by railway structures in the world's most railway-dominated city.

These research findings have clear and current application. The relationship between a terminus and its surrounding neighbourhoods is particular to each area. However, the wider associations identified by the research between railways and neighbourhood separation are likely to be very widely applicable, with local variation depending on other contemporary and historical factors. Although we think of railways as long-established pieces of the city, their impact is current. It is therefore importance to reinterpret and understand the persistence of infrastructure and of natural features in modern urban settings, from railways and canals, to Roman roads and buried rivers. The past may be forgotten, but it continues to leave its physical mark on modern London.

Consideration of the historical influences on place can help to counter the tendency to think of infrastructure in relation to past models rather than individual locations. Changing concepts of what infrastructure should be, such as shifts towards cycling provision, also require new thinking about the nature of established infrastructure. In the Netherlands, for example, terminals in Antwerp, Rotterdam and Utrecht have been redesigned to incorporate different transport modes, and to act not only as public spaces but also as through routes, accepting their role as functional elements of their cities rather than simply transport hubs. Stations in the UK and elsewhere, including Western Europe, are increasingly functioning as places in their own right, as part of the city, at least for those who can afford to shop in them.

While London is the world's premier railway terminus city, many other UK and world cities and towns contain similar, extensive railway structures, and are likely to experience similar effects. It is reasonable to assume that network phenomena observed in relation to London terminals will have relevance, it varying degrees, to terminals in other cities, particularly those with railways built more than a century ago, and to other non-terminus London stations. Further research is required to explore the wider application of these findings to different places both in the UK and beyond.

The research has direct relevance to the way development is approached in London, and in other cities. Much has changed since the 1880s, but this thesis looks back 130 years in order to question whether railway terminals should still be developed in a way the Victorians would recognise. The needs of the national rail network are dominant and, as the High Speed Two (HS2) project at Euston has demonstrated, a railway project on a large scale takes precedence over local priorities, needs or concerns. Houses and businesses are demolished, residents relocated and neighbourhood activity and street life replaced by construction works that takes place over many years. Health and safety provision may have improved, but the process is otherwise very similar to the railway construction work described by Charles Dickens in Dombey and Son (Dickens, 1848). There are few scenarios in which such destruction and such disruption to people who happen to live nearby would be contemplated. Each rail project is judged on its own merits such as, in the case of HS2, the improvements it will deliver in speed and capacity on the London-Birmingham rail route. Local impacts are considered a proportionate price to pay when compared to long-term social benefit. However, a longer-term perspective reveals each individual rail expansion and improvement project as part of a continuing pattern of disruptive change which, as the research findings show, have a disproportionate impact on poorer places over centuries. This scale of impact, over such a long period of time, is not something that policymakers are equipped to identify or to address.

This viewpoint suggests a need to conceptualise development differently. The improvement of life chances in London requires continued efforts to equalise opportunity. Spatial separation, as this research shows, is closely linked to long-term economic and social disadvantage. This consequences of railway development, understood clearly by the

Victorians but since accepted as a necessary side-effect, therefore needs to be strongly challenged. If railways are to be built and stations redeveloped, as they inevitably are, more attention should be paid to preventing or, if all else fails, mitigating these effects. Connections across railway lines to prevent separation should be included in designs as a matter of course, and their costs justified through the investment they provide in wider social benefit. Consideration should be given to decking over all railway throats, and a long-term project planned to deliver this objective. Decking would have the substantial benefit of delivering new development in the best connected, central locations, and has been achieved in other global cities. However, the nature of projects such as HS2, delivered by a bespoke organisation with self-contained objectives, makes the achievement of wider public benefit beyond the project 'red-line' very difficult. The illusion that railways are sealed, separate piece of infrastructure with little relationship to the places they pass through should be challenged, as it is convenient to infrastructure builders but damaging to railway neighbourhoods.

Station buildings, particularly terminals, should be design as integral parts of cities rather than as black boxes. Where the opportunity arises, such as with the Euston HS2 Station, to design a new station concourse cues should be taken from cities that built their railways later and are less encumbered by enormous Victorian rail sheds that, while delightful to use, form blockages in the street network of an exceptional size. Consideration should be given to placing station platforms underground, served by tunnels, and designing surface structures as part of the surrounding urban grain, interacting with the street network. It is possible to design underground platforms well, but this has not yet been achieved in Britain. Where listed station buildings will remain part of the city indefinitely, connections through and around them should be prioritised, and new routes opened up. This would benefit wider connectivity, but also the stations themselves which, increasingly, aim to attract footfall from passers-by as well as passengers.

Finally, the temptations of scale should be resisted. Railway projects dominate because of their size. Projects in dense central locations are always difficult and expensive so, when they do arrive, they become impossible to resist as large amounts of time and money are sunk into making them possible. In this context, the values of the small, the local and the low-key cannot compete. Yet, London and all other cities thrive on the collective contribution of the small, distinctive businesses which create identity and activity, and the presence of people who have a stake in a neighbourhood, and do not just pass through. These benefits are entirely subsumed in the face of a new station, but in many ways they are harder to generate and are impossible to directly replace. The choice between the large and the small is a loaded one, in which the metrics employed and political priorities that direct them can only ever deliver an answer in favour of the railway. The challenge is to break out of this destructive, confrontational mode of thinking about the future of cities and consider how railway neighbourhoods, and places like them, can be valued as crucial ingredients in a successful city and seen as worthy of investment, rather than as dormant redevelopment opportunities waiting for the next train to arrive.

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